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CONTENTS

Botanical results of the Tyler-Duida Expedition (plates 17–26) ..... *H. A. Gleason, with the collaboration of G. H. H. Tate, C. B. Hitchcock, Albert C. Smith, Jason R. Swallen, N. L. Britton, M. Burret, K. Krause, G. A. Malme, and L. B. Smith* 277

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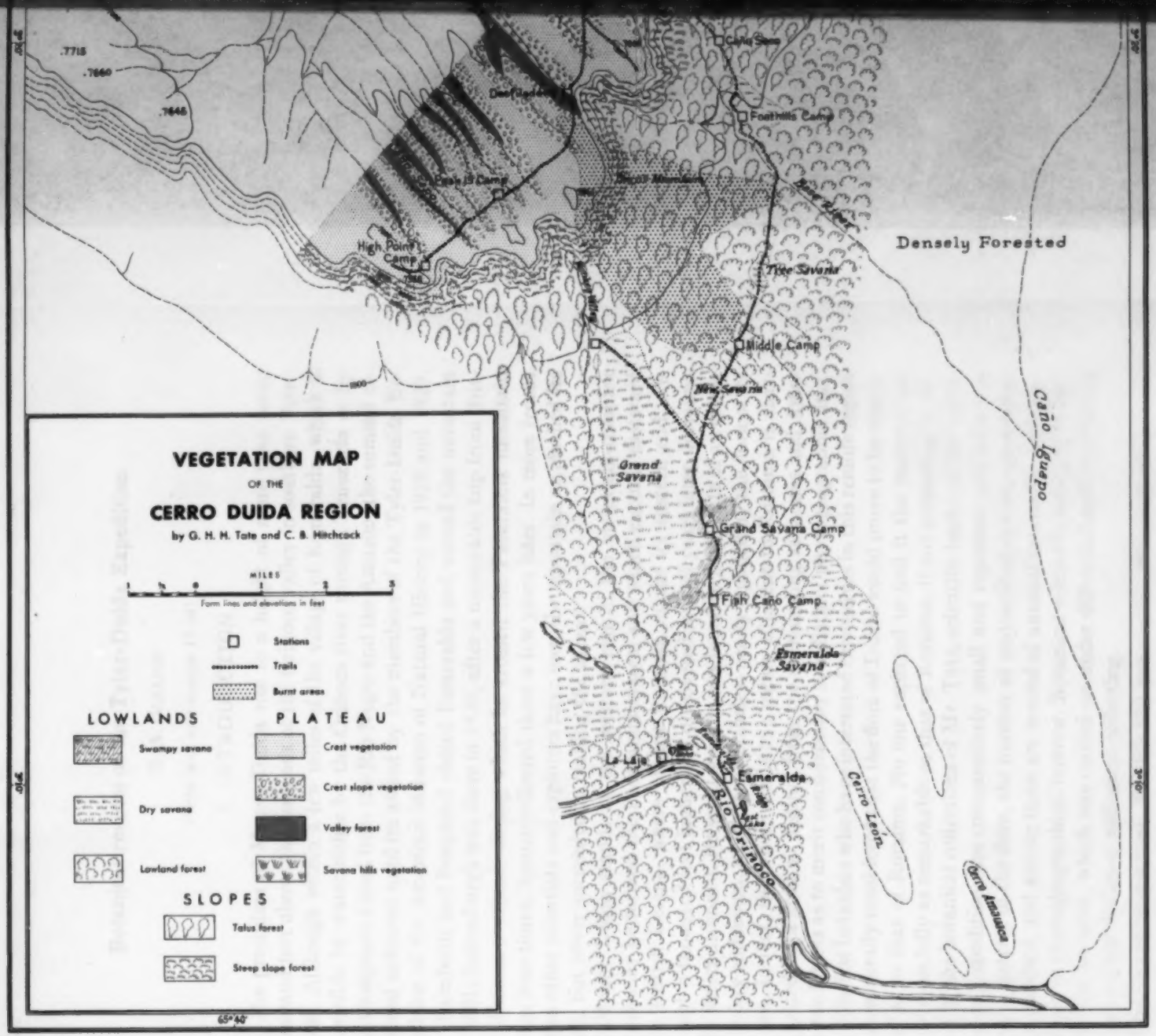
VEGETATION MAP
OF THE
CERRO DUIDA REGION
by G. H. H. Tate and C. B. Hitchcock
MILES
Form lines and elevations in feet
Stations
Trails
Burnt areas
LOWLANDS
Swampy savana
Dry savana
Lowland forest
PLATEAU
Crest vegetation
Crest slope vegetation
Valley forest
Savana hills vegetation
SLOPES
Talus forest
Steep slope forest
Densely Forested
Caño Iguapo
Río Orinoco
Cerro León
Cerro Arenoso
Foothills Camp
Eagle's Camp
High Point 1 Camp
Middle Camp
Grand Savana
Grand Savana Camp
Fish Caño Camp
Esmeralda Savana
Esmeralda
La Laja
Tiger Savana
New Savana
.7715
.7660
.7645
65°40'

Sauna Hills
Brockhinia Hills
Central Camp
Vegas Falls
Valley Head Camp
Provisional Camp
Agua Linda
Aguita
Cano Seco
Defiladero
Foothills Camp
Peak 15 Camp
High Point Camp
Tree Savana
Middle Camp
Densely Forested
.7715
.7660
.7645

Savana Hills
Lafonte Valley

Botanical results of the Tyler-Duida Expedition

H. A. Gleason

(with map and plates 17–44)

I. INTRODUCTION

The precipices of Mount Duida rise to a height of more than seven thousand feet above the lowlands of the Orinoco valley in southern Venezuela. Although within a few miles of the village of Esmeralda, which is accessible by water either by the Orinoco river through Venezuela or by the Casiquiare Canal from the Rio Negro and the Amazon, the summit remained unknown until its ascent by the members of the Tyler-Duida Expedition of the American Museum of Natural History in 1928 and 1929.

Humboldt and Bonpland visited Esmeralda and viewed the mountain in 1801; Schomburgk was there in 1839, after a memorable trip from British Guiana overland, during which he crossed the Pacaraima mountain range four times; Spruce collected there a few years later. In more recent times other scientists and explorers have seen the mountain or reached its base, but never succeeded in making the ascent.

Mount Duida stands at the western end of the mountain-complex which may be termed the Pacaraima system and which extends eastward into British Guiana, where Mount Roraima marks its eastern end. Although a thousand feet higher and discovered several years later, Roraima was earlier ascended. Its small summit was found to be the site of an extraordinary endemism, which is nevertheless nearly equaled by the flora of its slopes. In fact, the whole sandstone region adjacent to Roraima is characterized by a flora so distinct from the surrounding savannas and Amazonian forests as to merit consideration as a distinct phytogeographic unit.

The few botanists who have interested themselves in this remote region have generally considered that the flora of Duida would prove to be closely similar to that of Roraima. No one expected to find it the center of an endemism fully as remarkable as that of Roraima, if not surpassing it. Although the botanical collections of Mr. Tate, scientific leader of the Tyler-Duida Expedition, are comparatively small and represent probably less than a quarter of the flora, the number of undescribed species approaches two hundred, and among these are several of unusual taxonomic, morphological, or phytogeographical interest. Botanical science is indebted to Mr. Tate for his work, which was carried on under difficulties and in addition to his regular duties of zoölogical collecting.

[The Bulletin for April (58: 203–276) was issued 3 November 1931.]

The botanical collections of the expedition were presented by the American Museum of Natural History to The New York Botanical Garden and have been incorporated into its herbarium. Their study was assigned to the author of this report and has been carried on partly in New York and partly in Europe, where the rich collections at Berlin, Geneva, and Kew furnished valuable material for comparison. Specialists in various groups and two members of the expedition have assisted and their contributions give to the report a degree of completeness and authority unattainable under single authorship.

The Torrey Botanical Club likewise acknowledges with gratitude the support of numerous members and friends who have contributed to the special publishing fund.

In the taxonomic part of the report below, families are arranged according to the well-known sequence of Engler and Prantl. Arrangement of genera and species is sometimes taxonomic, sometimes alphabetical, as adopted by the various collaborators. Full citations of locality are given for each species, as far as provided by the field notes of the collector. Types of all species here described are in the herbarium of The New York Botanical Garden. Duplicates were supplied for contributing specialists wherever possible, and remaining duplicates, unfortunately few in number, are in the United States National Herbarium.

Under each family, the plants of Amazonian affinity are presented first, under the caption *Lowland species*. These include all the collections made by Tate on his journey to and from Duida and as far as the lower slopes of the mountain itself. The remainder of the collections are placed under the caption *Species of Mount Duida* and include all the plants collected on the summit or upper slopes of the mountain. This division has been made not merely for convenience but primarily because it represents a distinct phytogeographic segregation. The upper altitudinal limit of the Amazonian flora is not precisely known, and undoubtedly varies more or less, but in general probably does not exceed 2500 feet. Since no collections were made by Tate over an altitudinal belt some 2000 feet in height, extending both above and below this probable limit, the Amazonian flora is by this division separated from the distinctive flora of the Pacaraima range, and scarcely a species is known from both sides of the dividing zone. As may be expected, the lowland species of the Amazonian flora include comparatively few novelties, since it has been repeatedly and extensively collected for more than a century, although, as in every collection from Amazonian South America, some undescribed species occur.

Photographs illustrating the mountain or plants and vegetation in the field were taken by Mr. Tate and are used by permission of the American

Museum of Natural History. Maps have been constructed by Mr. Chas. B. Hitchcock from his personal field surveys.

II. NARRATIVE OF THE EXPEDITION[1]

The Tyler-Duida Expedition, organized by the American Museum of Natural History, New York, which has already been briefly reported on,[2] was sent into the field with the main objective of ascending the hitherto unclimbed Mount Duida in order to study its geography and biology and gather reports and collections of specimens. The party[3] left New York July 20, 1928; reached Esmeralda, ten miles from Duida, October 1; ascended to the summit of Duida first October 24; left Esmeralda March 18, 1929, and again landed in New York May 20.[4] The route taken was via Pará up the Amazon to Manáos; from that city up the Rio Negro to the mouth of the Casiquiare Canal and through the 212 miles of the canal to the point where its waters leave the upper Orinoco; finally up the canal for some twenty miles to Esmeralda, a tiny settlement on the north bank. Arrangements were made for our launch to return for us as nearly as possible in the middle of March, 1929.

In the late afternoon of the last day of our journey, as the boat thrust its way up the rippleless Orinoco, here about one fourth of a mile in width, the flood forest which had thus far lined its banks abruptly gave place to the savana of Esmeralda, and we noted a few hundred yards from the river a low adobe house thatched with banana and palm leaves standing in an enclosure surrounded by a wooden paling. Beyond, the grassland, upon which some two score head of cattle grazed, extended back to a row of low rocky hills, the Esmeralda Ridge. A short way up the river the bank forest reappeared. Our attention, however, was almost at once claimed and held by the sight of the stark precipices and enormous mass of Mount Duida, which rose vertically to a height of a mile and a quarter and, even though ten miles away, seemed to dominate the entire northern horizon. As we unloaded the baggage our eyes returned again and again to the object which we had traveled so far to investigate and we frequently stopped work to point out to one another some feature of its topography (Pl. 17).

[1] By G. H. H. Tate.

[2] Tate, G. H. H. and C. B. Hitchcock, The Cerro Duida region of Venezuela. Geogr. Rev. **20**: 31–52. 1930.

[3] The personnel consisted of Mr. Sidney F. Tyler, Jr., Mr. R. S. Deck, ornithologist, Mr. C. B. Hitchcock, geologist and cartographer, and the writer. The expedition was joined in Brazil by A. M. Olalla and brother with their four assistants, professional bird-collectors.

[4] As explained subsequently, Messrs. Tyler and Deck returned ahead of the expedition on account of ill health.

Two needs had to be taken care of immediately: an adequate number of Indians to work for us must be arranged for, and we had to determine just where along that formidable array of precipices and headlands an attempt to reach the summit should be launched with most probability of success. The matter of the Indians was settled fairly easily and in a few weeks we had about twenty-five men at our disposal. After careful study of the mountain, which appeared to be roughly rectangular with one of its angles

Fig. 1. Diagrammatic outline of a headland of Mount Duida: the adjacent valley occupied by forest, the headland bounded by cliffs and interrupted by two precipices. The dotted line indicates the route followed in the ascent.

pointing directly southward at us, we reached the conclusion that the southwest scarp, on account of its very precipitous and almost unbroken form, presented too great an obstacle. The side facing southeast, on the other hand, was cut up into a number of prodigious headlands separated by short ravines of immense depth. The length of the southwest face appeared about fifteen miles, that of the broken southeast face about ten miles.

Each headland appeared to consist of a higher and a lower portion, and each portion of a sharp crest terminating in a precipice with a roughly

triangular face. It seemed possible that we might ascend one of the valleys until we had passed the terminal precipice of a promontory, turn at right angles, and climb its flank up to the knife-edge crest, along which we would advance to the next precipice. Skirting its base, as in the first case, we hoped to climb its steeply sloping sides to its crest and then walk inward to the main mass of the mountain. Although even more difficult in practice than we had anticipated, the actual ascent followed more or less this plan (Fig. 1).

Having selected the most promising of the headlands and valleys, Hitchcock and I, with four Indians, food for several days, hammocks, and machetes, set out in search of the best approach. Our way took us across the Esmeralda Savana, through dense forest filled with magnificent palms, to another large and very beautiful savana (Grand Savana) situated at the foot of the southern angle of Duida. We crossed this and again plunged into forest, coming out occasionally into natural clearings filled with long grass, thickets of "caña brava," or tree savanas, concerning which more will be said later. We tried to hold our course parallel with the southeast face of the mountain, but much delay was occasioned when we crossed or had to go round large burnt areas, now covered with an almost impassable litter of great tree-trunks overgrown with lush masses of *Heliconia*, pokeweed, *Costus*, and other plants. As a rule, it was impossible to see the mountain at all, on account of the thick forest, and the occasional glimpses we had were insufficient for us to determine which part we were viewing. Eventually we came upon a good-sized stream (Base River), flowing from the foot of the cliffs at about the middle of the southeast side, and this we followed up. At length we were rewarded with a fairly uninterrupted view of the tip of one of the promontories which seemed to rise close to us, while our stream seemed to come from the ravine beside it. We reached the conclusion that this was the headland which we had selected for our attempt. We were now at the foot of the forested talus slope and made a camp (Base Camp). The next morning we started upward along the course of the stream in an attempt to pass the foot of the precipice in which the mountain spur ended. In this we were not only successful, but reached a height of 2100 feet on its flank. The weather turned bad, however, our food became exhausted, and the men tired and discouraged, so we returned to Esmeralda to refit.

There we found a number of Indians ready for work, whom we dispatched at once with orders to widen, straighten, and improve the trail, build camps at certain points, and try to cut upwards through the forest of the ridge and gain the lower crest of the promontory.

Some time later I set out again, this time with Tyler. We found that a

good straight trail had been cut through to Base Camp, that the huts were almost completed, and that the men had almost reached the lower crest of the ridge. Taking three men, we pushed up to the lower crest, where vegetation was scrubby and dwarfed, and along to the foot of the second precipice, which almost stopped us. However, we succeeded in skirting this also and put forth all our efforts for the final climb, perhaps the hardest of all, up the flank of the ridge to the higher crest. When finally we reached our objective, we found ourselves enveloped by mist. After a short rest we commenced, still ascending, to move along the crest to the body of the mountain. Difficulties continually appeared: spots where the ridge narrowed to almost nothing and the ground on either side crumbled; great hummocks of rock twenty to fifty feet high, their bases enveloped by wiry bushes, their sides and summits clothed with tough, cushiony herbage, over which we had to find our way. At length, the fog clearing for a few minutes, we found ourselves at the base of the headland adjoining the plateau and gazed over a gloomy panorama—a vast misty tableland rolling in giant waves, the whole inclining gently away from the scarp up which we had ascended. Tired out, we sat in a tangle of wiry brush which grew waist-high around us, looking right and left across great gulfs at neighboring headlands whose height cut off all further view.

Upon returning to Base Camp we instructed the Indians to improve the trail, make it their first duty to find drinking water on the plateau, and form a temporary camp on the summit (Provisional Camp).

About this time Tyler and Hitchcock and a few weeks later Deck left the expedition on account of ill health. Hitchcock returned in December, but Tyler went on down the Orinoco and eventually to New York; Deck came back so weak and ill with malaria that it seemed advisable to send him home at once.

Directly Provisional Camp on the summit was finished, I moved up there so as to be able to direct the construction of the long trails needed for getting about on the plateau. The path to the plateau was now vastly improved. In its construction more than 150 ladders and inclined bridges had been built by the Indians. The weather for the first week or so (end of November) remained generally cold and wet, but brief periods when it cleared allowed me to form a good conception of the topography of most of the mountain-top, to select localities which promised to be of major interest, and to have paths cut by which they might be reached and campsites in readiness for occupation at each one.

Road building was exceedingly hard work, partly on account of the uneven terrain, but especially because of the frightfully tangled vegetation. The men had to cut through almost continuous thickets while near

the ridge-tops, and in the valleys tunnel through a dense murky forest twenty feet in height and composed for the most part of semi-recumbent tree-trunks swathed in moss. Besides working in the rain, they were cold at night and short of rations, every scrap of which had to be carried up the ladder trail to them.

An important feature was the preparation of a central camp far enough from the edges of the cliffs to escape excessive mist and rain. The place selected was some three miles from the southeast escarpment where a maximum of sunshine was obtained daily. This station served as the main depot for reserve stores and for drying and storing specimens.

In a limited way, an understanding of the factors producing the strange fauna and flora present on Duida was not difficult. Here was an elevated mass of quartzite whose strata prior to its uplift had been profoundly folded, their strike being approximately northwest-southeast, or parallel to the southwest scarp. The headlands represented the crests of these folds; the valleys, the troughs. A gradual accumulation of vegetable matter almost unmixed with inorganic material covered most of this great area of 250 square miles of corrugated surface. Added to this was a climate intensely rainy for nine months out of the twelve and, due to elevation, a temperature between fifty and sixty degrees Fahrenheit. The result of the interplay of these factors upon any organism which was able to survive them after penetrating into the area was profound, as shown by the present biota.

On December 13 I received word that Hitchcock had returned. He asked me to go down to Esmeralda and help him measure a base line for his survey of the mountain. The weather, which had been fair for some time, broke badly at the period of "los nortes," so that I was glad to be down in the less tempestuous lowlands for a while. I returned to the summit December 21 and Hitchcock arrived ten days later. On December 30 I moved the Olalla contingent, who had hitherto been employed in the lowlands and on the slopes, into a special camp (Valley Head) on the plateau.

We planned to devote the next two months to a complete exploration of the summit. The first trail finished wound southwest along the top of the cliffs —a perfect switchback of a trail, now rising 500 feet to the crest of a fold, now falling a thousand feet to the next trough—to reach finally High Point Camp at 7600 feet. This station, representing the highest reached by us on Duida, was perched upon the southernmost tip of the plateau and overlooked not only the entire interior plateau and mountains to the north, but also the Orinoco lowlands east, south, and west for a distance of fifty miles. Along this trail several subsidiary stations were lo-

cated. It was while we occupied this camp that Deck returned and I had to go down to arrange for his transportation back to Manáos.

The work at High Point completed, we withdrew to Central Camp, stored away our collections, replenished our stores, and moved out to the station at the center of the plateau named Savana Hills. As our stay at this, the last of the camps on the summit, drew to a close, we received repeated warnings that the rainy season was iminent. Frequent afternoon storms came upon us and several heavy rains. The bridge across a deep, rock-bordered stream (Caño Negro) was twice carried away.

Reluctantly we commenced our withdrawal. Equipment and collections were moved back to Central Camp, and as quickly as possible that station also was dismantled and moved down the mountain. Short stays were made at Agüita, part way down the cliffs, and again in some of the lowland camps, but the object of the journey had been accomplished and we had little to do but move out to Esmeralda and await the launch.

III. CERRO DUIDA AND THE GUAYANA HIGHLANDS[1]

In discussing physiographic and geological relationships of the Duida region, it seems better at the present time to suggest possibilities of relationship between the mountain mass of Duida and the surrounding country of the Guayana Highlands, rather than to restrict words to local details of the mountain itself.

Mount Duida is composed of a strongly folded series of reddish and white conglomeratic sandstones and purple shales.[2] The physiographic interpretation of the mountain front suggests strongly a series of extensive faults, an extensive block mountain bounded by steep walls, but the impressiveness of the abrupt cliffs is perhaps of less interest than its summit. This surface has been referred to as a plateau, an easy method of depicting the broad extent of the summit, but from a strict definition this application of the term is quite incorrect. The summit is not a plateau, but an old mature surface partially broken by tectonic movements accompanying the up-faulting, partly dissected by processes of weathering and stream erosion.

Four hundred miles to the east lies Mount Roraima, also composed of red and white conglomeratic sandstone and red shales. These sediments were named by Dalton[3] the Roraima series. The latter, far from being com-

[1] By C. B. Hitchcock.

[2] Tate, G. H. H. and C. B. Hitchcock. The Cerro Duida region of Venezuela. Geogr. Rev. **20**: 31–52. 1930.

[3] Dalton, L. V. Venezuela. London, 1912.

plexly folded, are flat bedded and appear to be the erosional remnants of a formerly widespread series.

What could be its former possible extent? A study of the scanty literature left by travellers in the country intermediate to these mountains shows that sandstone mountains occur in patches throughout the region. In the head-waters of the Rio Caroni, Holdridge[1] reports mountains of similar appearance. Toward the upper reaches of the Rio Caura, André[2] says of Cerro Arawa: "the mountain loomed ahead of us in forbidding grandeur. Just before sunset, the heavy bank of clouds which had been hanging over its summit cleared up, revealing the height of its precipitous sides, and the fantastic shapes into which the plateau had been cut." From other portions of the text it is evident that he found this mountain to be composed of sandstone. Here, as in the headwaters of the Caroni and at Roraima, are the same general types of mountains, isolated to a certain degree, but forming connecting links between the eastern extension of sandstone and the Parima system. At the headwaters of the Uraricuera and Parima, Rice[3] described folded sandstones. Schomburgk[4] observed in 1839 that the sandstone mountains, scattered along his route from Cerro Roraima to the west, became considerably more indurated as he approached the eastern flank of Sierra Parima. At the foot of Cerro Sarisharinima, of about 4000 feet elevation, he observed[5] that the rubble at its foot "ist der Sandstein auch viel crystallinischer."

It is interesting to note that as he crossed the main ridge of the Parimas he observed coarse-grained granite in which large bands of hornblende were predominant. It seems unlikely that he would mistake its general type if there were a predominantly coarse, crystalline rock of this nature. The physiographic aspect of the Parima range, when viewed from the summit of Duida, tends to substantiate this observation. Rounded, apparently wooded summits lead one to suspect an igneous or metamorphic rock as the cause of such a topographical feature.

To the west of the Parima range, we again encounter metamorphosed sandstones and shales at Duida. A hundred miles to the west Cerro Yapacana, which stands near the right bank of the Orinoco, is of sedimentary origin. Although it was not actually visited, the sedimentary nature of the

[1] Holdridge, Desmond. Notes on an exploratory journey in southeastern Venezuela. Geogr. Rev. **21**: 373–378. 1931.

[2] Andre, E. A naturalist in the Guianas. New York, 1904. p. 218.

[3] Rice, H. The Rio Branco, Uraricuera, and Parima. Geogr. Jour. **71**: nos. 2–4. 1928.

[4] Schomburgk, R. H. Reisen in Guiana und am Orinoko. Leipzig, 1841.

[5] Op. cit. 428.

rock was obvious. The stratification, quite plain to the naked eye, showed slight folding, but the beds were comparatively flat.

To these might be added the observations of Koch-Grünberg, Passarge, and others, whose contribution to the geography of the Guayana Highlands do not add particularly to the specific problem of sandstone distribution. Koch's description of the upper Rio Ventuari extends the known boundary of sandstone well to the north of Duida, but makes no vital change in the other observations. North of the Orinoco and to the west, the extent of former sandstone distribution is not known. The close affinity of the majority of Roraima and Duida birds to those of the Andes[1] indicates strongly a former connecting link to this mountain system, but whether north, west, or both is a matter of future investigation.

The presence of sandstones and quartzites over this wide area, the general similarity of the red and white conglomeratic sandstones and shales, the apparently increasing metamorphism in proximity to both eastern and western flanks of the Parima axis, and the resumption of approximately horizontally bedded mountain masses at a distance from the Parimas, suggests a correlation of the Duida sediments with the Roraima series. At some time since the deposition of the sandstone, orographic disturbance, possibly accompanied by igneous intrusions (e.g. Schomburgk's observations) took place along the axis of the Parimas.

The best evidence for the age of the Roraima sediments is well summed up by Liddle.[2] He states that "the age of the Roraima series is not definitely known. It bears, however, a striking lithologic similarity to sediments of Lower Cretaceous age, which are exposed in the Coast Range, in the Venezuelan Andes, and in the Sierra de Perija. Especially is the resemblance between this series and the Barranquin formation of northeastern Venezuela noticeable, and it is with this formation that the correlation is made."

If the Duida sandstones be of equivalent age to the Roraima series, a somewhat more complex history must be given to the Guayana Highlands.

Liddle[3] states that "Since the deposition of the Roraima series there seems to have been no noticeable movement of the Guayana Highlands. . . . So far as indicated by the rocks which compose it, this old land area has been relatively stable since earliest geologic time. It has been submerged probably not more than twice—once during the Paleozoic when the

[1] Chapman, Frank M. Problems of the Roraima-Duida region as presented by the bird life. Geogr. Rev. **21**: 363–372. 1931.

[2] Liddle, R. A. The geology of Venezuela and Trinidad, 123, 124. Fort Worth, Texas, 1928.

[3] Op. cit. 124.

Imataca series was deposited and once during early Cretaceous time when probably the Roraima series was laid down."

If the sandstones of Duida are correlatable with the Roraima series, which from the point of view of distribution and lithologic similarity seems quite likely, one more chapter is added to their post-Cretaceous history. Following the deposition of the sediments, the orographic movement took place along the Parima axis as stated above. Following this, a long period of peneplanation truncated the folded sediments of the central Parima area. Presumably the land at a distance from the folded area lay at comparatively low altitude, although it is impossible to state the amount of material removed from its surface during the formation of the peneplane. Since then, broad uplift over the entire region has occurred, post-peneplane faulting has taken place in the region of previous mountain-making. Weathering and erosion have done their share in carving out the flat-lying and folded sediments into their present expression. It seems logical to believe that the faulting, exhibited to such a marked degree on Cerro Duida, must have commenced at least in late Tertiary time. Low scarps in the talus parallel to the southwestern front of Duida give indication of probable faulting in recent times.

The purpose of giving these observations is not to state a definite history, but to point out what seems to be a possible correlation and history of this widespread and little known sandstone formation. If this serves as a basis for future observations, it serves its purpose.

IV. ASPECTS OF VEGETATION AND PLANT ASSOCIATIONS[1]

In discussing the areas of plant associations of the Duida region, such a wealth of distinct local environments must be dealt with that it has been thought advisable at the beginning to draw up a table to show environmental subdivisions, together with a base map upon which their geographical position may be plotted. It is hoped in this way that they may be made more easily intelligible. Each division will be briefly characterized and some of the more noteworthy plants mentioned (pl. 17–21).

- Lowlands
  - Esmeralda area
    - Riverside
    - Flood (igapo) forest
    - Savana
      - Dry phase
      - Swampy phase
    - Ridge
  - Grand Savana
    - Dry outwash from talus slopes
    - Swampy phase
  - Other open areas
    - Grass savana
    - Tree savana
    - Caña brava thickets
  - Forested areas
    - Unburned phase
    - Replacement phase

[1] By G. H. H. Tate.

- Slopes
  - Talus portion
    - Drier ridge tops
    - Moist valleys
  - Steep portion
    - Cloud forest
    - Crest slope and Bromeliad zone[1]
- Plateau
  - Greater part of area: Soils of greater or less thickness of pure humus (the generally prevalent condition), occurring as very humid phase (at edge of cliffs) or moderately humid phase (remote from cliffs)
    - Crests
      - Dry phase
      - Swampy phase
    - Slopes
    - Valleys
    - Stream beds and banks
    - Replacement flora after fire
  - Restricted area at center: Soils compacted and formed mainly of iron laterite, both hematite and limonite being present (known only near the Savana Hills near the center of the plateau, not exceedingly humid)
    - Crest
    - Slope
      - Swamp phase
      - Dry phase
    - Rocky
    - Wooded
    - Stream

The Duida region is at once divisible into lowlands, slopes, and plateau, each division manifesting in turn a greater or less number of subdivisions, as follows:

ESMERALDA AREA

The vicinity of Esmeralda is a rather extensive savana[2] running back from the Orinoco River half a mile and with a length of about a mile, across which, about 100 feet above the plain, the low Esmeralda Ridge extends, formed of the shattered quartzite rock which Schomburgk mistook for granite. At either side of the savana adjoining the river and to the northwest it is bounded by the Orinoco flood forest, and northeast and east by normal lowland forest. Much of the land, which rolls gently, is well drained sandy soil. It is clothed by grasses, of the genera *Aristida*, *Andropogon*, and *Leptocoryphium*, among which grow the savana tree *Byrsonima crassifolia*, the pink-flowered herbaceous melastome *Pterogastra major*, the gentian *Chelonanthus* and the milkwort *Polygala hygrophila*. Behind the ridge and east and west of Esmeralda, the swampy part of the savana is drained by several streams along which small "morichales" are formed together with their characteristic floral communities. These swamps, the second of which contains no moriche palms, drain from the side of the ridge toward the Orinoco east of the palm swamp (See map). The sandy marsh farther east has scattered moriches and many interesting plants, among which are groups of the large pink-flowered *Rhynchanthera*

[1] So named because of the extensive development of the giant Bromeliad, *Brocchinia* sp.

[2] This spelling has been consistently followed by Mr. Tate in accordance with the practice of the American Geographical Society.

grandiflora, numbers of sedges of the genera *Lagenocarpus*, *Cyperus*, *Psilocarya*, and *Eleocharis*, the little palm *Lepidocaryum*, the blue-flowered *Abolboda macrostachya*, and the new *Monotrema xyridoides*. Among smaller plants are a number of species of *Eriocaulaceae*, *Lentibulariaceae*, *Burmanniaceae*, *Droseraceae*, and *Lycopodiaceae*. This swamp merges with East Lake, along whose margin are found two peculiar plants, one a mauve-flowered plant of the *Scrophulariaceae*, *Naiadothrix reflexa*, its tiny leaves dissected like miniature chamomile leaves, the other *Mayaca Sellowiana*, growing in patches, erect, with tiny whorled leaves that make the plant resemble *Polytrichum*.

Speaking generally, the flora of the savana, whether due to cattle feeding there or to repeated burning, seems much impoverished.

Considering now Esmeralda Ridge, visited by Richard Spruce in December, 1853, the grasslands of the savana often sweep up almost to the crest, but among the broken rocks grow not only a number of trees and bushes but also numerous herbs. Among the former may be mentioned *Clusia columnaris*, the odd-looking *Qualea esmeraldae*, the Berberis-like melastome *Acanthella conferta* with its flaming orange flowers, and species of *Cassia* and *Byrsonima*. The latter include the beautiful tall white and yellow orchid *Sobralia liliastrum*, *Smilax Benthamiana*, *Mandevilla mollissima*, and species of *Anthurium* and *Pitcairnia*. Under the shelter of the rocks live the ferns *Oleandra hirta*, *Anemia buniifolia*, and *Lindsaya*, together with a number of mosses, liverworts and lichens. On the crest of the ridge one or two swampy pans occur where *Xyris savannensis* and *Syngonanthus gracilis* grow.

The flood forest, while showing no unusual features, varies from densely tangled vine-covered forest to relatively open park-like woods (the tree savanas of Esmeralda) bordering areas permanently covered by water. In many places huge growths of "razor-grass" (*Scleria* sp.) spring up at the commencement of the dry season and cover many of the lower trees. In the river itself certain floating plants, *Piaropus crassipes* with air-filled leaf-bases and others, grow outward over the water from the partly submerged branches of the igapo.

GRAND SAVANA

This prairie, which as previously stated is the large area of savana adjoining the southern tip of Duida, appeared when discovered to be in virgin condition. As we crossed the lower swampy part adjoining the forest near Esmeralda it presented a lovely sight—fresh and moist after the rains, its verdant surface was broken here and there by low flowering bushes and taller stands of cyclanths. The shrubby growth included the red-berried

Humiria floribunda spathulata, the low straggly *Heteropterys oblongifolia*, and very commonly *Qualea esmeraldae*, with its large whitish, somewhat papilionaceous flowers. Of lower plants, I may mention the bromeliad *Brocchinia prismatica*, a pretty yellow-flowered orchid, *Xyris subglabrata* with orange-yellow flowers, as well as a host of grasses, sedges, *Eriocaulaceae*, and *Xyridaceae*. From this lower part the ground swept gradually up to the talus slope of the mountain. The dry portion, across which several little palm-fringed streams meandered, was much less varied as to vegetation. Here a *Cuscuta* grew commonly as well as many of the plants of the dry parts of Esmeralda Savana. A tongue of the upper savana, becoming rather bushy in places and dividing the talus slope forest of Monkey Valley from that to the northeast, reached up the talus to nearly 1000 feet on Burned Mountain. On its slopes a pretty white-flowered melastomaceous bush, *Acisanthera erecta*, was abundant.

LONG GRASS SAVANAS

Only one example of this type, named New Savana, was encountered. Our trail crossed it between Grand Savana and Middle Camp. Grass usually four, and in no place less than two feet high, clothed part of it. A very few scattered savana trees, including *Byrsonima* and two Dilleniaceae, were present. Soon after its discovery the Indians burned off the grass. This they did later to Grand Savana also.

TREE SAVANAS

This name we applied particularly to an environment between Middle Camp and Base River, but a rather similar example was found on the ridge just east of Foothills Camp, where in addition the orchid (*Sobralia*) of Esmeralda Ridge grew profusely. The ground was uneven, stony, and generally covered with crisp harsh grass about a foot in height. Tree Savanas was separated into small grassy areas by scattered groups and belts of low, sometimes gnarled trees, including *Clusia columnaris* and *Protium guianense*, and bushes such as *Humiria balsamifera*, *Humiria savannarum*, *Retiniphyllum Schomburgkii*, and the melastomes *Macairea pachyphylla*, *Miconia stenostachya*, and *Ernestia tenella*. In the shade of the trees little spaces of ground carpeted with *Selaginella radiata* and the curious-looking fern with fingered fronds, *Actinostachys pennula*, could be found. More rarely the tall purple orchid *Epistephium parviflorum* and the vine-like *Blepharodon venezuelense* were noted here.

CAÑA BRAVA THICKETS

Although found only along the brook at the western edge of New Savana, this densely matted thicket of Caña Brava sedge eight feet

deep may well be considered as constituting a distinct association area. Tall moriche palms were scattered through the canebrake.[1]

LOWLAND FORESTED AREA

The lowland or Amazonian forest in the Duida region may be thought of as a matrix which surrounds each one of the savanas of the district. Occasionally narrow tongues of this forest push out into the savanas. The igapo forest of the river bank passes gradually over into the drained forest, certain parts of which, having no positive direction of run-off, have developed an insequent system of small trenches surrounding the base of the larger trees into which water drains. The water in these depressions, although practically stagnant, seems gradually to find its way out to definite water-courses. In general, however, the forest has a well defined drainage system comprising the numerous small streams which cross from the talus slope of Duida to the Orinoco. The soil, which is sandy, overlies in places quartzite conglomerates perhaps derived from the Duida beds of quartzite. Its humus content, as may be expected, is high.

From the botanical standpoint, the forest is perhaps best distinguished from other Amazonian forests on account of the relative abundance of magnificent palms. A phase in which palms quite predominated was met between Middle Camp and Tree Savana. Here the most striking kind of palm has graceful twenty-foot leaves and appears at first sight to be stemless, for the leaves start from the ground and arch over. Individuals of this type are really young, and about five young are seen for every adult tree with trunk. Trees which are relatively common are the "moura," three species of Annonaceae, *Bocagea multiflora*, *Aberemoa asterotricha*, and *Anaxagorea acuminata*, whose bark is used for making ropes and fibers, and the cigarette tree, whose inner bark, split into thin layers, is employed by the natives for wrapping cigarettes. Enormous clusias, bignonias, Apocynaceous vines, etc., drop their flowers in due course as their months of flowering pass by. The average diameter of the trees (not palms) is from twelve to fifteen inches. Every fifty yards or so a giant of the forest with trunk thickness of three or four feet is met. At Middle Camp one could as a rule see for only about twenty feet through this forest. Since the expedition was not equipped for collecting the flowers and fruit of the great forest trees, anything secured was obtained incidentally through the breaking down of limbs or making of clearings.

Along the lower part of Base River the forest grew very tall, with a rather open but high undergrowth of *Heliconia*, etc. rooted upon the silts

[1] The name caña brava is generally applied in Latin America to tall grasses with the aspect of sugar cane.—H.A.G.

and bordering flood plains built up by the river. Nearer the mountain, as the ground became rougher and more tilted, the lowland forest gave place imperceptibly to the forest of the talus slope which had characteristics of its own.

REPLACEMENT VEGETATION OF LOWLAND FOREST

Wherever the woods had been burned, and this had occurred in many places, a wealth of succulent plants, mainly Scitaminales but also *Cecropia*, *Pteris*, and thorny "cariñoso" (*Solanum*), had quickly grown up and covered the welter of half-burned trunks and roots. At Middle Camp solid walls of this herbage might be seen, after it had been cut and piled up out of the way by the road makers. In some places we came upon what may have been a later phase of replacement, bushy growth swamped by masses of vines, Convolvulaceae, and a pleasant tasting *Passiflora* (named locally Paujcha). The largest burned area extended from around Middle Camp up a great part of the talus slope and precipitous part of one of the southern promontories called by us Burned Mountain and, as found subsequently, actually reached the summit of the plateau.

TALUS SLOPE FOREST

The forest of the lower parts of the Duida slope, although intergrading with that of the lowlands, contains numerous elements which are rare or absent from the latter, such as the taraña or gum used by the Indians for lighting fires and making torches and false balata or "pulga negra," a huge latex-bearing tree whose balata however is very inferior. In spite of the fact that many species drop out as in turn others appear, this talus forest may be thought of as reaching far up the southeast scarp toward the cliff-encircled heads of the ravines. It does not, however, ascend the steep slopes such as Agüita. The lower part of the forest is represented by the flora present at Foothills Camp (800 feet) and Monkey Valley Camp (750 feet), the upper part by Caño Seco Camp (1800 feet). As with the lowland forest, the arboreal flora of the talus slope and steep slope forests is but poorly collected, the plants secured on the slopes being mainly herbs and bushes.

STEEP SLOPE FOREST

These woods, whose separation from the talus forest may be considered arbitrary, in my conception are confined to the steep sides of the great ravines below the crest slopes of the promontory, and while controlled rather by the factor of exposure than by that of altitude may be regarded as forming a definite belt separating the uppermost talus forest from the vegetation of the crest slopes and summit. It is met again toward the de-

pressed center of the plateau about Savana Hills, which it seems to have reached from the exterior by way of the gorge of the Caño Negro, but here it is considerably modified by the addition of a number of plants whose affinities are with the plateau flora. This forest, on the exterior scarps, occurs typically at Agüita (2300 feet) and upward as far as the "Bromeliad zone" (3800 feet), marking the beginning of the crest slope of First Ridge. Its trees, though tall, are smaller and slenderer than the immense trees of the talus forest, and in large measure are of different species. At its upper edge they dwindle still more in size until at the less steep, though much exposed crest slope, they appear definitely stunted. This place also marks the lower limit of such plateau trees as *Archytaea multiflora* and *Bonnetia longifolia*. On rocks in exposed places on this crest the flame-flowered orchid *Hexisea bidentata* grows. Among lesser vegetation of the Agüita forest may be mentioned *Smilax floribunda* and especially two gesneriaceous plants, *Episcia cordata* with variegated leaves and tubular mauve flowers and *E. cuneata* with small white flowers resembling violets, both of which were taken at Agüita growing on a rock-face down on which water seeped.

Considering now the same class of woods at Savana Hills, we note its presence in three separate minor environments: along the south side of the gorge of the Caño Negro, where the fern *Elaphoglossum latifolium* is plentiful; in a pocket on the southern slope of Savana Hills close to camp, where a number of interesting plants, including *Saxo-Fridericia regalis*, the great arum *Philodendron*, the composite tree *Stenopadus talaumifolius*, and orchids of the genera *Pleurothallis*, *Lepanthes*, *Maxillaria*, *Epidendrum*, *Scaphyglottis*, and *Sobralia*, grow; and, in a more open phase, on the north slope of the same in a valley named Laterite Valley. These patches of forest seem to differ slightly among themselves, that by the camp being especially rich in the terrestrial aroid.

THE PLATEAU

The greater part of the folded plateau constituting the mountain-summit has a soil covering of almost pure humus, but at the center there appears to have been a downwarping of the tableland combined with general fracture of the strata in a southwest-northeast direction, resulting in soil modification. By some means, not yet ascertained, this transverse cracking of the strata has been accompanied by a concentration of iron, manifested by the iron laterite soil of Savana Hills Ridge. The ridge, together with the deep canyon of the Caño Negro, cutting directly across the prevailing folded structure of the mountain and diverting the drainage, seems to lie parallel to this line of fracture. Some indication of the changed nature of the soil is also noticeable at Brocchinia Hills, just south of the Caño

Negro. Discussion of the floral regions of the plateau will deal first with the areas of humic soil and later the more local conditions found at the center of the tableland.

In the humus soil division two sets of climatic modifiers combine to produce the highly varied and complex results observable. On the one hand we see crest, slope, and trough repeated serially as we pass from northeast to southwest across the ridges. The scarp as a whole, however, attains more and more absolute altitude, so that from 6300 feet, the height of the crest over which we made the ascent, an altitude of 7800 feet is reached in the extreme southwest at High Point. The second set of factors operate at right angles, northwest to southeast, to the above, and are two: decreasing altitude brought about by tilting of the tableland as a whole away from the cliffs, and diminishing humidity due to greater distance from the scarp-face up which clouds continually drift. A glance at the map will illustrate. Points of maximum humidity are met in the troughs of valleys at the edge of the precipices and conversely the crests of ridges near the center of the plateau are the driest. It may be emphasized here that since exposure-vegetation is found far down the ridges and sheltered floras reach far up valleys—to such a degree that the lowest range of the former may be far below the highest range of the latter—obviously the factor of exposure (or shelter) is vastly more influential than the factor of altitude above sea-level.

VEGETATION OF THE CRESTS OF THE PLATEAU

Speaking broadly, the crest ridges of Duida, each one of which includes several minor phases, are much alike. In cases where the crest is low and broad the slope vegetation (see beyond) passes over it unaltered. When the crest is high and partly or wholly denuded of soil a specialized crest vegetation is developed and this vegetation extends far down (to 4000 feet) on the exposed knife-edges of the promontories.

Perhaps the most usual association on exposed crests is a low, tightly packed, cushiony growth of the pitcher-plant *Heliamphora Tatei* or *Navia*, or wiry growths of assorted shrubs. These are often more or less segregated, here an area of pitcher-plants, there a carpet of heathy or bromeliaceous growth. Scattered through this are a great variety of plants, of which but a few, *Odontoglossum*, *Zygopetalum Tatei*, *Maxillaria*, *Schefflera umbellata*, *Tibouchina fraterna*, *Retiniphyllum erythranthum*, *Conomorpha duidae*, and *Epidendrum inconstans*, may be cited. If the rock is nearly bare, plants growing about it become correspondingly reduced; on the other hand slight dips or sheltered pockets contain all sorts of shrubs, ferns and dwarfed trees, such as *Meriania duidae*, *Abolboda Sceptrum*, *Stegolep-*

is guianensis, Dendrophthora roraimae, Graffenrieda polymera, Pterozonium Tatei, etc. The pockets marking the junction of steep slope forest of the escarpment with the crest vegetation are especially varied and interesting. Here for instance, besides the heavy growth of *Brocchinia* sp., often with the blue-flowered *Orchyllium Humboldtii* growing in its leaf-bases, are found the yellow-flowered shrub *Tateanthus duidae, Anthurium quinquenervium, Eupatorium Tatei,* etc. The "Bromeliad zone" on the promontories, which divides crest vegetation from steep slope forest, I regard as an extension of the slope vegetation of the ridges of the plateau, in which *Brocchinia* is a very important element. Minor developments on the crest are little swampy depressions containing *Sphagnum, Abolboda Sceptrum, Maxillaria, Heliamphora, Stegolepis,* and various Lentibulariaceae, sedges, xyrids, and Eriocaulaceae.

SLOPE VEGETATION OF THE RIDGES OF THE PLATEAU

Once more several phases are observable. Near the precipice the slope flora changes from deep wiry brush adjoining the crest progressively to taller and stouter, more succulent and moss-hung vegetation as the heads of the trough-valleys are reached. These changes seem to be dependent primarily on the degree of exposure. Again, as one traces the slope vegetation along the ridge and away from the cliffs, it once more becomes larger, but this time the lessened rainfall tends to produce a small-tree type of woods which grows straighter and is less hung with mosses and liverworts, though still filled with underbrush and Bromeliads. The brushy growth comprises a great wealth of species of *Ternstroemia, Psychotria, Tyleria, Bonnetia, Stenopadus, Grammadenia, Cyrilla, Duidania, Conomorpha, Ilex, Purdiaea, Mikania, Oedematopus, Chalepophyllum, Clusia, Schefflera, Phoradendron, Didymopanax, Phthirusa, Weinmannia,* and others.

The station at High Point Camp was located by the nearest water—a mere trickle—and was some 400 feet below Peak 7. The ascent crossed two small ridges called respectively first and second Ridges of Peak 7. These are parted by two small valleys containing Valley Head forest, with a reduced undergrowth of *Brocchinia* sp. On the exterior or scarp faces of the peak the plants still show the effects of exposure, but the numerous pockets and crevices afford ample shelter locally in which profuse vegetation is found.

On or closely adjoining the top of the peak occur *Thibaudia truncata, Mycerinus sclerophyllus, Monnina duidae, Didymopanax rugosum* and *reticulatum, Clusia pachyphylla, Gaylussacia cacuminis, Gongylolepis glaberrima, Phyllanthus duidae, Burmannia foliosa, Ditassa duidae, Podocarpus roraimae,* as well as *Purdiaea, Grammadenia, Ternstroemia, Gongylo-*

lepis, Cyrilla, Ilex, Graffenrieda, Psychotria, Weinmannia, etc. The herbaceous plants of the crest are *Heliamphora Macdonaldae,* which forms a firm cushion over the very peak of the mountain, the orchids *Epidendrum carnosum, E. inconstans,* and *Eriopsis grandibulbosa,* and others such as *Tofieldia,* Bromeliads, *Blechnum, Alsophila* (in protected places) and various xyrids.

Forest fire from below had ascended and burned a portion of the plateau vegetation of the headland named Burned Mountain (Ridges 21 and 22). A very limited replacement flora, composed of *Polytrichum antillarum, Funaria calvescens, Nephrolepis cordifolia,* and *Mikania duidensis* was observed.

FOREST OF THE VALLEYS OF THE PLATEAU

In the troughs of these valleys and the lower part of the slope forest we see another of the extraordinary vegetational features of the Duida plateau. Tree-trunks sprawl semi-recumbent or entirely so along the the ground for twenty feet before raising their branches to the forest ceiling. In some cases a foot of humus soil buries them. They appear extremely slow of growth, being thick and gnarled, with branches short and blunt and leaves often in terminal whorls among which large (usually pink) flowers open. The undergrowth is dense, brittle, and often succulent, containing *Brocchinia, Rapatea, Heliamphora,* ferns, etc., and the lower parts of the entire forest are buried in enormous growths of reeking hepatics, mosses and lichens. Following one of these valleys (Central Valley) from the cliff-edge (Valley-head Camp) northwest, the trees, except in the deepest parts, tend as with the slope forest to be less often prone and by reason of drier conditions to be less hung with moss. Even at Central Camp, three miles from the scarp, where the clearing of the site involved removal of many bizarre trees such as *Tyleria,* prone tree-trunks were the rule. It is my opinion that in many cases the prostrate condition of the tree-trunks is brought about by the instability of the humus soil, the trees literally falling over in it at some time of their growth and then growing up again. The soil yields to the tread and literally quivers for feet around if one jumps upon it. Camp fires burn their way down into it. Outstanding forms at Central Camp were *Byrsonima cretacea, Psychotria campylopoda, Archytaea multiflora, Bonnetia tristyla, B. longifolia* and *B. crassa, Tyleria floribunda, T. spathulata,* and *Retiniphyllum erythranthum,* and near the brook *Diacidia vestita.* The forests of the valleys and lower slopes of the ridges, as they near the lower levels at the center of the plateau, gradually transform themselves into the steep-slope woods already described at the Caño Negro. Regarding the upper ends of these same valleys, in one or two of the smaller and higher ones (as at Ridge 15 and High Point) the

gnarled trees are seen to become smaller and smaller and finally to cease altogether without reaching the edge of the cliffs, but in Central Valley and at Desfiladero Camp the valley forest terminates only at the brink of the precipice.

In each valley a stream originates. Deep and narrow at its source, the water colored brown by the prevailing humus, these streams farther down their course form a series of deep rock-pools or even quite high falls (i.e. Vegas Falls). Since they are subject to great freshets their vegetation is necessarily very firmly anchored and wiry. Frequently the entire rocky bed is covered by the strongly modified *Paepalanthus capillaceus proliferus*. The banks are lined by *Luxemburgia duidae*, *Duidaea pinifolia*, which resembles a dwarfed spruce, *Ravenia linearis*, and the wiry little melastome *Macairea linearis*. The greater part of the stream beyond reach of flood is overhung by branches of the valley forest. Here and there small deposits of sand relatively low in humus may be noted, where *Perama scaposa* grows. This species is found also high on ridges, as at Peak 7.

Mention should be made of parts of stream beds which have very rocky sides, such as at the humid Provisional Camp and Central Camp. Here a multitude of plants occur, such as mosses and hepatics, *Selaginella microdonta*, *Xyris duidensis*, various Lentibulariaceae, *Poteranthera duidae*, *Hymenophyllum*, *Tofieldia Schomburgkiana*, and *Pterozonium*.

SAVANA HILLS, CENTER OF DUIDA PLATEAU

As already explained, the fundamental distinction at Savana Hills is the development of a laterite soil in place of a humus soil. Savana Hills, unfortunately, is found to be rather a misnomer. When first seen (from Ridge 25 ten miles away) the ridge gave the impression of being savana-covered. Much later it was found to be clothed mainly by bromeliads with tough spiny leaves, and to have relatively little grass. Lying almost at the center of the plateau this station was reached by a trail from Central Camp which passed by Vegas Falls and Brocchinia Hills, descended the forest-clad southern slope of the deep gorge of the Caño Negro, and, crossing the stream by a log bridge, climbed the steep, dry, sandy northern bank to the camp.

The ridge, generally speaking, is formed of a series of large knolls several hundred feet above the gorge. The crest and much of the slopes are dry and clad scantily with brush and shrubs. In a pocket through which a tiny brook passes close by camp the steep-slope forest, already mentioned, is developed, and on the opposite or northern side of the ridge the more open woods of Laterite Valley. Broadly speaking the upper, savana-appearing slopes are chiefly covered with bromeliads, the lower parts border-

ing the gorge of the Negro being lightly wooded with *Tyleria*. The northern side of the gorge produces a number of local plants, *Leitgebia guianensis*, *Xyris stenophylloides*, *tenella*, and *duidensis*, *Panicum obovatum*, *Selaginella scalariformis*, *Duidaea Tatei*, and *Ledothamnus parviflorus*. Cracks in the bare rock in the bottom by the river give anchorage to still others, including *Duidaea pinifolia* and flood-torn specimens of the remarkable *Barbacenia Alexandrinae*.

Probably the crest of the ridge, which is without question the headquarters of *Barbacenia Alexandrinae*, produces the greater part of the plants indigenous to Savana Hills, while the slopes, although provided with a most interesting flora, are a transitional type between the flora of laterite soil crest and that of the remainder of the plateau. Besides *Barbacenia*, the crest of Savana Hills produces shrubs of *Tibouchina fraterna*, *Clusia rotundifolia*, *Remigia laevifolia*, *Pagamea montana*, *Myrcia sylvatica*, *Macairea rigida*, *Ouratea* sp., *Ilex duidae*, *Graffenrieda ovalifolia*, *Byrsonima bracteolaris*, *Conomorpha lepidota*, and the crimson-flowered *Bejaria variabilis*. Most of these plants are scattered along the ridge, being only slightly massed in the depressions. The low growth is composed mainly of spiny-leaved bromeliads with occasional specimens of *Calolisianthus Tatei*, *Chelonanthus pyriformis*, *Metastelma mirifolium*, *Calea abelioides*, *Stenophyllus*, *Everhardia*, and *Echinolaena inflexa*.

On the southern slope, swampy ground by the camp produces small trees, *Clusia*, *Tyleria*, etc.; shrubs, including *Duidaea rubriceps* (the buds resembling small cones), *Chalepophyllum latifolium*, *Ilex retusa*, the mucilaginous *Macairea lanata* and *Tococa oligantha;* and herbaceous plants, *Lindsaya stricta* and *pendula*, *Stegolepis pungens* and *linearis*, *Epidendrum*, various sedges, *Leiothrix turbinata*, *Panicum curvifolium*, *Xyris*, *Amphiphyllum rigidum*, the tubular growths of *Brocchinia reducta* (also on Brocchinia Hills), and the magnificent pitcher-plants, *Heliamphora Tyleri*.

Just east of this swampy part the rock is to a great extent exposed. Here the aroid *Philodendron* and slender-leaved spinous bromeliads grow. The dry slope below the crest but above camp level bears scattered bushes of *Thibaudia glandulosa*, *Humiria floribunda montana*, *Retiniphyllum*, and the tree *Couma utilis* quite loaded with edible fruit, as well as bromeliads, sedges and apocynaceous vines.

V. LIST OF PLANTS COLLECTED, WITH DESCRIPTIONS OF NEW GENERA AND SPECIES

HYMENOPHYLLACEAE[1]

Lowland Species

TRICHOMANES PINNATUM Hedw. River-bank at Foothills Camp, 750 ft., *397;* a common and heteromorphous species found throughout tropical America.

TRICHOMANES CRISPUM L. Foothills Camp, 750 ft., *379;* a widespread and variable species in tropical America.

Species of Mount Duida

HYMENOPHYLLUM SERICEUM Sw. South bank of Caño Negro, Savanna Hills, 4400 ft., *852;* a species of general distribution in tropical America.

HYMENOPHYLLUM CRISPUM HBK. On tree trunk, Central Camp, 4800 ft., *551;* south bank of Caño Negro, Savanna Hills, 4400 ft., *1036;* a plant of wide distribution in tropical America. The Mt. Duida specimens are more delicate and feathery than typical material. With *1036* is mixed a fragment which can probably be referred to *Hymenophyllum brevifrons* Kze., a diminutive species sparingly distributed from Cuba to Brazil.

TRICHOMANES PLUMOSUM Kze. Among rocks in woods, 50 feet below summit of Peak 7, 7050 ft., *663;* an Andean species.

TRICHOMANES CRINITUM Sw. Under a sloping tree trunk, Ridge 25, 5500–6000 ft., *444.* Distribution, tropical America. The present specimen is less pubescent than West Indian material. Possibly more than one species is represented among the material referred here.

TRICHOMANES ACCEDENS Pr. In brook-bed under ledges, slopes of Ridge 25, 5500–6000 ft., *445.* In referring the present specimen to *T. accedens,* some latitude must be allowed in regard to the shape of the pinnae, which in the illustration of Hooker and Greville (Ic. Fil. t. 12. 1827) are adnate on the rachis, and in Tate's plant are more or less contracted at the base. Quite probably a careful study of this difficult and confused group will establish the specific identity of many additional specimens. The range of the true *T. accedens* is uncertain, it probably being rare in the southern West Indies and the north coast of the continent.

CYATHEACEAE[1]

Lowland Species

HEMITELIA MULTIFLORA (Sm.) R. Br. San Gabriel, Rio Negro, Brazil, *140.* Distribution, throughout tropical America.

[1] By Albert C. Smith.

ALSOPHILA BLECHNOIDES (Rich.) Hook. Forest at Middle Camp, Esmeralda, *352;* woods at Foothills Camp, 750 ft., *377*. A well-marked species of wide distribution in tropical America.

Species of Mount Duida

CYATHEA SCHANSCHIN Mart. Plant 8 ft. tall, 50 ft. below summit of Peak 7, 7050 ft., *668;* plant 3 ft. tall, Agüita Slope, 3800 ft., *865*. The Mt. Duida specimens have somewhat smaller fronds than typical material of this widespread species.

HEMITELIA MACROSORA (Baker) Jenm. Camp Woods, Savanna Hills, 4400 ft., *849*. Characterized by long, pendulous, much-divided fronds. Previously known only from Mt. Roraima.

The following specimens were not referred; *402*, *451*, *626*, material insufficient for description; probably *Alsophila* or possibly *Hemitelia* and probably two new species are represented; *665*, juvenile, probably of this family.

POLYPODIACEAE[1]

Lowland species

OLEANDRA HIRTA Brack. Under rocks, summit of Esmeralda Ridge, *230;* a specimen which agrees perfectly with the type of *O. hirta*, with the single exception that the scales of the rhizome of our specimen are a trifle broader in proportion and have the margins faintly ciliate, a difference which hardly seems specific. Previously known only from the Organ Mountains of Brazil.

NEPHROLEPIS BISERRATA (Sw.) Schott. Manáos, *12*. Common in tropical America.

ASPLENIUM SERRATUM L. Woods at Foothills Camp, 750 ft., *384*. A widespread species in tropical America. The Mt. Duida specimen is somewhat smaller than typical material.

PITYROGRAMMA CALOMELAENA (L.) Link. Manáos, *13*. Common in tropical America.

ADIANTUM TOMENTOSUM Kl. Forest at Middle Camp, Esmeralda, *351*. Distribution infrequent, Guiana and Amazonian Brazil.

POLYPODIUM POLYPODIOIDES (L.) Hitchc. Epiphytic, woods at Foothills Camp, 750 ft., *380*. The fronds of this specimen are less scaly than those of typical material of the widespread species.

POLYPODIUM LINDBERGII Mett. Epiphytic, woods at Foothills Camp, 750 ft., *387*. Distribution Brazil and Paraguay.

No. *232*, a sterile specimen of *Lindsaya*, probably a simply pinnate form of *L. stricta* (Sw.) Dry., was not referred.

[1] By Albert C. Smith.

Species of Mount Duida

OLEANDRA ARTICULATA (Sw.) Presl. Agüita Slope, 3100 ft., *887*, *937*. A species of general distribution in the West Indies and northeastern South America, often known under the synonym of *O. nodosa* Presl.

Oleandra duidae A. C. Smith, sp. nov. Rhizomate ascendente, squamis lanceolatis attenuatis dense vestito; phyllopodiis sparsis longis; stipitibus olivaceis glabris; frondibus late linearis glabris, basi cuneatis, apice longe acuminatis, margine cartilagineis; costa superne canaliculata, glabra, nervis lateralibus simplicibus furcatisque; soris serie irregulari costae approximatis.

Rhizome scandent, 2–3 mm. in diameter, densely appressed-paleaceous, the scales imbricate, lance-attenuate, 6–8 mm. long, about 0.8 mm. broad, castaneous with lighter borders and base, faintly serrate and ciliate towards the long-acuminate apex; phyllopodia distant, 15–30 mm. long, glabrous or with a few scales at the base; stipes 3–6 cm. long, olivaceous, glabrous, grooved on the upper surface; lamina subcoriaceous, glabrous, broadly linear, 15–30 cm. long, 4–5 cm. broad near the middle, tapering in both directions, the base cuneate, the apex long-acuminate, the margins cartilaginous; costa olivaceous, slightly grooved above, elevated beneath, glabrous or deciduously scaly; veins single or in pairs, 13–16 per centimeter near the margin; sori few, 1–1.5 mm. broad, forming an irregular series 2–8 mm. from the costa; indusia orbicular-reniform, glabrous, entire.

At Central Camp, 4900 ft., *580*. This species allies itself to the group of *Oleandra* which has an ascending rather than a creeping rhizome, and especially to those species with a long phyllopodium. Of the two species of this affinity hitherto described, *O. guatemalensis* Maxon and *O. Lehmannii* Maxon, the Mt. Duida species more closely resembles the former. It seems to merit specific rank on the basis of its broad fronds, its large rhizome scales (about twice as long as those of *O. guatemalensis*), its large sori and its lack of costal scales at least in mature fronds.

NEPHROLEPIS CORDIFOLIA (L.) Pr. Agüita, 3100 ft., *892;* burned-over ground on Burned Mountain, 6500 ft., *707*. A widely distributed and variable species.

HYMENOPHYLLOPSIS. This remarkable genus was founded by Goebel[1] on a plant described by Baker[2] as *Hymenophyllum dejectum*. In discussing it Goebel points out that its relationship is with *Polypodiaceae* rather than *Hymenophyllaceae*. Its position within the family is uncertain, some morphological characters being primitive while others are derivative; it probably belongs with the tribe *Davallieae*. I place in this genus a fern from Mt.

[1] Flora N. F. **24**: 3. 1929.

[2] Hook, Ic. Pl. **17**: t. 1610. 1886.

Duida which agrees in details of structure with *H. dejecta*, although in general appearance it is very distinct. This fern may be known as:

Hymenophyllopsis asplenioides A. C. Smith, sp. nov, Rhizomate erecto, paleis longis dense vestito; stipitibus teretibus; frondibus bipinnatifidis, ovato-lanceolatis, rachidibus alatis; pinnis primariis alternis vel subopppositis, oblongo-lanceolatis; lobis alternis, obliquis, furcatis; venis obscuris; soris terminalibus in lobis, bi-indusiatis; indusiis persistentibus, ovatis.

Rhizome erect, ligneous, up to 2 cm. in length, stout (2–4 mm. in diameter), the younger part densely paleaceous, the scales delicate, stramineous, lanceolate from an oblong base, 1.8–2.5 mm. long, 0.2–0.4 mm. broad at the base, tapering to an acuminate tip, the cells in 6–10 irregular longitudinal series with pale delicate walls; fronds densely caespitose, the stipes terete, dark brown, stout (about 0.8 mm. in diameter), about 1 cm. long (rarely 2 cm.), deciduously paleaceous with scales similar to those of the rhizome, the lamina coriaceous, dull olivaceous, glabrous throughout, ovate-lanceolate, 7–12 cm. long, 2–3.5 cm. broad at the middle, tapering both ways, bipinnatifid, the primary rachis similar to the stipe in texture, winged throughout; pinnae 10–30 per side, lower ones subopposite, upper ones alternate, horizontal or slightly ascending, close (2 or 3 per centimeter), oblong-lanceolate, adnate at the base, up to 18 mm. long and 5 mm. broad (the lower ones reduced and irregularly palmate, the upper ones reduced as regards the number of divisions), the secondary rachis broadly winged, obscure; lobes alternate, oblique, 4 to 7 pairs below the dichotomously lobed apex, the basal ones sometimes irregularly palmate and sterile, sometimes dichotomously forked, in which case the lower fork is sterile, oblong, blunt, 3–4 mm. long, about 1 mm. broad, the upper fork fertile, oblong, about 0.5 mm. broad and 1 mm. long exclusive of the sorus, the upper lobes similar to the fertile branch of the lower lobes (the apical ones sterile); venation obscure, the veins following the branching of the pinnae; sori terminal on the lobes, bi-indusiate, the indusia of the same texture as the lamina, persistent, ovate, 1.2–2 mm. long. 1–1.5 mm. broad, fused on the outer margin which is often narrowly winged, inner margin usually free, entire, upper margin crenate with 4 or 5 irregular crenations not exceeding 0.15 mm. in length, the receptacle terminating a vein, lying between the indusia at their base, subhemisperical, somewhat flattened, about 0.3 mm. across the base, sporangia few (not more than 7 to a sorus), subsessile, obovoid, about 0.5 mm. on the long axis, cells of the annulus thick-walled, opaque, broad (especially those of the middle) (Pl. 22).

In brook-bed under ledges, slopes of Ridge 25, 5500–6000 ft., *439*. It is a species which in such characters as the rhizome, rhizome scales, texture, venation, and soral arrangement agrees with *H. dejecta* (Baker) Goebel. It differs in having the frond plane, much less pinnatisect, and with broader segments, and the stipe very short. Considerable variation is shown in the arrangement of sori; usually the indusia are joined along the

outer margin only, but rarely both margins are fused and occasionally both are free. Sometimes the soriferous vein is obscurely forked at the receptacle, one branch leading into the receptacle while the other leads a short distance up the wing at the fusion of the indusia, as though suggesting a sterile lobe. Superficially the present plant resembles *Asplenium theciferum* (HBK.) Mett. in the cutting of its pinnae.

LINDSAYA STRICTA (Sw.) Dry. Slopes of Ridge 25, 5500–6000 ft., *430;* moist slopes of Savanna Hills, 4400 ft., *777*. A species distributed throughout the South American tropics.

LINDSAYA CRENATA Kl. Agüita, 3100 ft., *893;* rare, known only from the southern part of British Guiana.

LINDSAYA FALCATA Dry. Agüita, 4000 ft., *904;* a species widespread in the American tropics, being abundant in Guiana.

LINDSAYA PENDULA Kl. Moist slopes of Savanna Hills, 4400 ft., *731;* a rare species previously found on savannas of British Guiana and northern Brazil, easily recognized by its small deflexed obcuneate pinnules.

BLECHNUM. Two species are represented, but both specimens are sterile. They are probably *B. acutum* (Desv.) Mett., first waterfall, 4900 ft., *577*, and *B. Boryanum* Schlecht., summit of Peak 7, 7100 ft., *650*.

Pterozonium cyclosorum A. C. Smith, sp. nov. Caudice subrepente, robusto, dense paleaceo; stipitibus dispersis, castaneis; frondibus coriaceis, oblongo-ovatis, glabris, basi cuneatis, apice rotundatis, margine integerrimo, plano; venis flabellatis, immersis; soris globosis vel oblongis, distinctis, ad venarum apicem productis.

Caudex subrepent, lignose, stout (4–6 mm. in diameter), densely paleaceous, the scales ferruginous, piliform, 4–6 mm. long, consisting of 15–25 cells; stipes about 15 to a plant, scattered (about 3 per centimeter of caudex), castaneous, 5–12 cm. long, slender, 3-angled, with a few minute piliform scales near the base; fronds coriaceous, oblong-ovate, 2.5–4 cm. long, 1.5–2 cm. broad, glabrous or faintly pubescent with minute black hairs (parasites?), the base cuneate, the apex rounded, the margins entire, cartilaginous, practically plane; venation flabellate, immersed, veins forking two or three times, 25–40 at their termination (1 mm. or slightly less from the margin); sori globose or oblong, seldom exceeding 1 mm. in length, distinct, produced at the apices of veins, the receptacles slightly sunken in the leaf tissue, round or elliptic; sporangia somewhat obconical, about 0.5 mm. on the long axis, cells of the annulus large, stalks short (0.2 mm. or less in length); paraphyses about 1 mm. long, of 5–10 cells.

In brook-bed under ledges, slopes of Ridge 25, 5500–6000 ft., *440*. It is a species resembling *P. cyclophyllum* (Baker) Diels, endemic to Mt. Roraima, from which it differs by having the caudex subrepent rather than erect, the stipes scattered rather than caespitose, the margins plane rather than revolute, and the sori round or short-elliptic, never linear.

Pterozonium Tatei A. C. Smith, sp. nov. Caudice erecto, lignoso, dense paleaceo; stipitibus caespitosis, castaneis; frondibus simplicibus, coriaceis, reniformis, glabris, basi cordatis, apice rotundatis, margine plano vel recurvato, serrato; venis flabellatis, immersis; soris oblongo-linearibus, ad venarum apicem productis, leviter conjunctis, zonam angustam intramarginalem formantibus; sporangiis paraphysatis.

Caudex erect, lignose, 3–5 mm. in diameter, 3–5 cm. in length, densely paleaceous, the scales ferruginous, piliform, 5–9 mm. long, consisting of 6–12 cells (the cells up to 1 mm. in length); stipes 10–15 to a plant, caespitose, castaneous, 6–16 cm. long, slender, subterete or slightly 3-angled, glabrous or with a few minute piliform scales near the base; fronds coriaceous, reniform, 12–17 mm. long, 20–30 mm. broad, glabrous or faintly pubescent above with minute black hairs (parasites?), the base cordate, the outer edge round, the margin plane or slightly revolute, regularly serrate, the serrations triangular, about 0.5 mm. in length, often in pairs; venation flabellate, immersed, veins spreading from the base, forking 3 or 4 times, 50–90 at their termination, each ending in a serration; sori oblong-linear, 1–2 mm. long, produced at or near the apices of the veins, distinct or barely contiguous, forming a narrow band about 1 mm. from the margin, the receptacles sunken in the leaf tissue; sporangia ellipsoid, about 0.5 mm. on the long axis, cells of the annulus with thick reddish-brown walls, stalks short (about 0.1 mm. in length); paraphyses dark red, of 4–6 cells, forming a cluster of 10–25 at the base of each stalk, surrounding the sporangium to half its length (Pl. 23).

In tufts, under cliffs, slopes of Ridge 25, 5500–6000 ft., *418*. This species appears close to *P. reniforme* (Mart.) Fée, a rare fern from Amazonian Brazil and Peru. However, the latter has the base of the lamina cuneate (rarely truncate), the serrations faint, and the sori arranged in a wide band several millimeters from the margin, while the Mt. Duida species has the base of the frond distinctly cordate, the serrations well-marked, and the sori arranged in a narrow band very close to the margin. In *P. reniforme* the sporangia are globose, with paraphyses longer in proportion than those described above.

Syngramma paraphysata A. C. Smith, sp. nov. Caudice erecto, paleis lanceolato-acuminatis nigrescentibus dense vestito; stipitibus caespitosis, castaneis, gracilibus; frondibus simplicibus, rigide coriaceis, ovato-lanceolatis, basi truncatis vel subcordatis, apice subacutis, margine integerrimo; venis pinnatis, furcatis prope costam vel simplicibus; soris linearibus, frondis faciem inferiorem praeter zonam marginalem et costalem occupantibus; sporangiis paraphysatis.

Rhizome erect, short, 3–5 mm. in diameter, densely paleaceous, the scales lanceolate-acuminate from an oblong base, nigrescent, 2–3 mm. long, about 0.5 mm. broad at the base, the cells opaque, in 6–10 longitudinal series with heavy dark brown partition walls; stipes densely caespitose, castaneous, 4–9

cm. long, slender (1 mm. in diameter), 3-angled, glabrous or sparsely paleaceous at the base; lamina thick-coriaceous, glabrous, often sulcate, ovate-lanceolate, 3.5–5.5 cm. long, 1.5–2.5 cm. broad, the base truncate or subcordate, the apex subacute, the margins entire, cartilaginous, plane or slightly revolute; venation pinnate, the costa shallowly grooved above, prominent beneath, the veins wide-spreading, forking from or near the costa (sometimes simple), raised above, plane or depressed beneath, about 8 per centimeter at their termination (less than 1 mm. from the margin); sori linear, 4–6 mm. long, borne on the veins midway between costa and margin, leaving a sterile band of 3–4 mm. along each side of the costa and of about 2 mm. along the margin; sporangia subglobose, about 0.4 mm. in diameter, cells of the annulus heavy-walled, stalks short (less than 1 mm. in length); paraphyses arising from the base of the stalk in clusters of 3 to 8, up to 0.7 mm. in length, of 6–9 cells.

In brook-bed under ledges, slopes of Ridge 25, 5500–6000 ft., *441*. It is a species belonging to the section *Austrogramme* Fournier, allied to *S. elaphoglossoides* (Baker) Diels and *S. brevifrons* A. C. Smith, both of which are endemic to Mt. Roraima. From both of these species it is distinguished by the shape of its fronds, its small nigrescent rhizome scales, its comparatively distant veins, the arrangement of its sori, and its paraphyses. The sori of *S. brevifrons* cover practically the entire lower surface of the lamina, of *S. elaphoglossoides* they leave a wide marginal sterile band, while of the present species they leave both a marginal and a costal band. Neither of the previously described species of this section have paraphyses; those of *S. paraphysata* are arranged in clusters, like those of *Pterozonium reniforme* and *P. Tatei*.

Psilogramme paucifolia A. C. Smith, sp. nov. Rhizomate elongato, parce paleaceo, paleis piliformibus; stipibus dispersis, multo elongatis; frondibus oblongo-linearibus vel lanceolatis, tripinnatisectis, rachidibus cum stipitibus pubescentibus; pinnis primariis alternis, oblongo-lanceolatis; pinnulis alternis, oblongis, extensis, pinnatisectis ad costam alatam, chartaceis, pallidis, glabris vel laxo hirsutis ad venis; segmentis obovatis, ad apicem divisis in duos vel tres lobos emarginatos; venulis subdichotomis; soris oblongis.

Rhizome elongate, repent, about 1.5 mm. in diameter, sparsely paleaceous, the scales reddish brown, piliform, 2–3 mm. long, consisting of 6 to 10 opaque cells; fronds scattered (about 1 per centimeter of rhizome), much elongated, 40–120 cm. long; stipe up to 40 cm. in length, about 1 mm. in diameter, becoming withered at the base, dark brown, subterete, deciduously pubescent with minute usually gland-tipped hairs (up to 0.2 mm. in length, of 1 to 3 cells); lamina linear-oblong or lanceolate, 20–80 cm. long, up to 11 cm. broad, tripinnatisect, the primary rachis similar to the stipe, more persistently pubescent; primary pinnae alternate, 15–20 per side (the lower ones deciduous), horizontal or slightly ascending, oblong-lanceolate, up to 6 cm. long and 2 cm. broad (the upper ones smaller), subequilateral, fully pinnate towards the base,

the secondary rachis above narrowly winged, sparsely clothed with glandular hairs (1–several-celled); pinnules alternate, oblong, spreading, 8 to 12 pairs below the blunt apex, pinnatisect to the winged costa, chartaceous, pale green, glabrous or laxly hirsute on the veins with scattered pale hairs; segments alternate, oblique, obovate from a cuneate base, 2 or 3 pairs below the blunt apex, cleft into 2 or 3 lobes, these bilobate at their tips; venation anadromous, veins of the pinnules subdichotomous, pale green, slightly raised on both surfaces, the ultimate branches terminating at the emarginate apices of the lobes; sori oblong (scanty on the present specimen), lying on the secondary veins of the pinnules midway between the costa and the apices of the segments; sporangia subglobose, about 0.25 mm. in diameter, short-stalked, nearly sessile.

Terrestrial on forest-covered slope, 50 feet below summit of Peak 7, 7050 ft., *677*. The present specimen is scantily fertile, so that mention of the sori is necessarily incomplete. It is allied to *P. hirta* (HBK.) Kuhn, from which it differs by having the segments more narrowly cut, the pubescence of the pinnules scantier, and the pubescence of the rachis obviously glandular. It is also close to *P. chiapensis* Maxon, a Mexican species which has the bases of the rhizome scales dilated. From both of these species *P. paucifolia* is distinguished by its uniformly shorter pubescence, its scattered rather than fasciculate stipes, and its tardily determinate fronds.

HISTIOPTERIS INCISA (Thbg.) J. Sm. Agüita, 4000 ft., *914*. A widespread species; also known from Mt. Roraima.

PTERIDIUM ARACHNOIDEUM (Kaulf.) Maxon. Desfiladero, 6000 ft., *716*. Distribution, the mountains of tropical America.

POLYPODIUM MONILIFORME Lag. Woods, Laterite Valley, Savanna Hills, 4400 ft., *766;* widely distributed in South America.

POLYPODIUM KALBREYERI Baker. Central Camp, 4900 ft. *578*. Distribution, in mountainous Central America and eastward to Mt. Roraima. The present specimen agrees in particular with those from Mt. Roraima.

POLYPODIUM CAPILLARE Desv. sens. lat. Epiphytic in woods, 50 feet below summit of Peak 7, 7050 ft., *675*. A species of general distribution, probably an aggregate.

POLYPODIUM DUALE Maxon. Woods, Laterite Valley, Savanna Hills, 4400 ft., *765*. A species of wide distribution in tropical America, distinguished from others of its group by the delicate scales of the rhizome.

POLYPODIUM STRICTISSIMUM (Hook.) Hieron. Valley between Ridges 23B and 23C, *600*. A rare species from Colombia to Guiana, known also from Mt. Roraima (*im Thurn 351*). The scales of the rhizome have thick dark partition walls. The present specimen is referable to the forma *minor* of Hieronymus.

POLYPODIUM NIGROLIMBATUM (Spruce) Jenm. Valley beyond Ridge

23B, on tree trunks, 5950 ft., *480*. A rare fern of the section *Grammitis* Sw. (as genus), also found on Mt. Roraima.

Polypodium haplophlebicum A. C. Smith, sp. nov. Caudice suberecto, dense paleaceo; stipitibus subcaespitosis, brevibus; frondibus simplicibus, oblongo-linearibus, basi attenuatis, apice subacutis, margine plano et valde crasso; venis pinnatis, simplicibus; soris globosis vel ellipticis, venarum calcarem adscendentem occupantibus.

Epiphytic; rhizome suberect, slender (about 1 mm. in diameter), densely paleaceous on the young parts, the scales pale brown, lanceolate-acuminate from a slightly contracted base, 2–3 mm. long, about 0.3 mm. broad near the base, the cells small, irregularly arranged in about 10 longitudinal series (at the widest point) with delicate walls; fronds numerous, subcaespitose, the stipes subterete, short (less than 5 mm. in length), the lamina glabrous or sparingly pubescent with minute black hairs, oblong-linear, 3–5 cm. long, 3–4 mm. broad, the base narrowly attenuate, the apex subacute, the margins plane, entire, and thickened into a heavy dark brown border (uniformly 0.2 mm. broad); venation regular, the costa thickened, the veins somewhat conspicuous, plane above, slightly raised beneath, subopposite, straight, spreading, 7 or 8 pairs per centimeter, of the sterile portion simple, of the fertile portion bearing a short ascending soriferous spur near the base; sori round (or slightly elliptic), about 1.5 mm. in diameter, often confluent, occupying the upper half of the frond, receptacles plane, elliptic, about 1 mm. in length, occupying the entire soriferous spur of the vein; sporangia crowded, subglobose, about 0.17 mm. in diameter, the stalks slender, about 0.3 mm. long.

Slopes and flats at Central Camp, 4800 ft., *553*. A species of the section *Grammitis*, allied to *P. leptopodon* C. H. Wright, endemic to Mt. Roraima, from which it differs by having the rhizome scales narrower, the stipes shorter, the fronds oblong-linear rather than oblanceolate, the veins simple (the soriferous spur being only long enough to accomodate the receptacle) rather than bifurcate, and the soriferous portion not limited to the apical part of the frond. The leaf tissue of the old fronds often decays leaving a peculiar skeleton of the veins and thickened border.

Polypodium pseudo-fraternum A. C. Smith, sp. nov. Rhizomate repente, lignoso, robusto, dense paleaceo; stipitibus paucis, castaneis, glabris, basi dilatatis; frondibus oblongis, pinnatis; pinnis simplicibus, subsessilibus, lanceolatis, basi inequaliter cuneatis, ad costam adnatis, apice subacutis, margine integerrimis; venulis anastomosantibus, unicum seriem costalem areolarum formantibus; soris globosis, areolas occupantibus.

Rhizome lignose, repent, up to 10 cm. in length, stout (5–10 mm. in diameter), giving rise to numerous long slender roots which are densely clothed with pale brown few-celled hairs, densely paleaceous, the scales castaneous, lanceolate from an ovate base, 5–7 mm. long, 1.5–2.5 mm. broad near the base,

the basal half dilated, strongly cordate, overlapping, affixed at a point about 1 mm. from the rounded lower margin, the upper half lanceolate, long-acuminate at the tip, the margins irregularly dentate with apiculate teeth 0.1–0.2 mm. long, each bisected by a rigid cell wall, the cells large (averaging 0.13 mm. in diameter), transparent, with thick rigid dark brown transverse walls, those of the basal part usually pentagonal, those of the upper part elongated; stipes few to a plant, 8–15 cm. long, about 1.8 mm. in diameter, castaneous, glabrous, sharply angled, dilated at the base; fronds oblong, 18–30 cm. long, 10–16 cm. broad, pinnate, the rachis similar to the stipe, the pinnae subopposite or alternate, distant (about 7 per decimeter), 8–12 per side with an erect terminal one, ascending at an angle of about 50°, subcoriaceous, glabrous, lanceolate, 6–10 cm. long, 5–7 mm. broad, the apex subacute, the base unequally cuneate, about 1.5 mm. broad at the attachment, adnate on both sides of the midrib (very slightly so on the lower side, about 0.8 mm. on the upper side), the margin entire, narrowly cartilaginous, slightly reflexed, sometimes shallowly crenate, the upper pinnae somewhat more adnate, the uppermost pair sometimes joined with the base of the terminal one which may be auriculate on one side; venation pinnate, the midrib prominent on both sides, the veins somewhat obscure, spreading, about 4 per centimeter, anastomosing to form a single costal series of subhexagonal soriferous areoles with a free included veinlet, the outer veinlets free, forking once or twice, ending within the margin; sori occupying the costal areoles, terminal on the included veinlet, distinct, round, about 2 mm. in diameter, the receptacle somewhat sunken, about 0.4 mm. in diameter; sporangia numerous, subglobose, about 0.3 mm. in diameter, the stalks slender, up to 0.4 mm. long.

Summit of Peak 7, 7100 ft., *644*, *645* (type). It is a species of the section *Goniophlebium* Blume, apparently nearest to *P. chacapoyense* Hook., a species of Peru and Bolivia, from which it differs in the shape of its pinnae and its lack of pubescence. The rigid cell-wall skeleton of the rhizome scales of *P. pseudo-fraternum* is a striking feature, found also in *P. chacapoyense*. The cell tissue often decays, leaving the skeleton quite intact. The present species bears a superficial resemblance to *P. fraternum* Schl. & Cham. of the section *Eupolypodium* Diels, from which it differs in details of external structure as well as in venation.

POLYPODIUM ANGUSTIFOLIUM Sw. Agüita, 3100 ft., *938*. Common in tropical America.

Cochlidium attenuatum A. C. Smith, sp. nov. Rhizomate erecto, dense paleaceo; stipitibus caespitosis, subteretibus, brevibus; frondibus simplicibus, coriaceis, linearibus, basi attenuatis, apice subacutis, margine plano; venis immersis, alternis, partium sterilium simplicibus, partium fertilium furcatis; coenosoris oblongis, venarum furcas superiores occupantibus.

Rhizome erect, slender (about 1 mm. in diameter), densely paleaceous, the scales hidden among the leaf bases, pale brown, lanceolate-acuminate from an

oblong base, 2–3 mm. long, about 0.5 mm. broad at the base, the tip short-pilose, the cells in 10–18 longitudinal series with delicate walls; fronds densely caespitose, the stipes subarticulate to the rhizome, subterete, less than 4 mm. in length, the lamina thick coriaceous, glabrous when young, becoming pubescent with minute black hairs (parasites?), linear, 8–12 cm. long, 1–1.5 mm. broad, narrowly attenuate at the base, subacute or rounded at the apex, rarely forked near the apex; venation obscure, the costa thickened, the veins immersed, alternate, of the sterile portion few, simple, ascending, about 2.5 mm. long, of the fertile portion distant (about 6 per centimeter), forked from or near the base, ascending, the upper branch parallel to the costa, about 3 mm. long, sometimes again forked at its tip, the lower branch slightly shorter and somewhat spreading; coenosori oblong, superficial, occupying the upper half of the frond, lying close to the costa on the upper branches of veins, 1.5–2 mm. long, usually not confluent; sporangia crowded, globose, about 0.2 mm. in diameter, cells of the annulus with heavy reddish-brown walls, stalks slender, short, about 0.2 mm. in length.

Slopes of Ridge 25, 5500–6000 ft., *428*. In general appearance the present species resembles *C. furcatum* (Hook. & Grev.) C. Chr. and *C. Connellii* (Baker) A. C. Smith, both of which have simple veins with receptacles nearly or quite terminal. In common with them, *C. attenuatum* has superficial polypodioid sori. Among the species with forked veins, *C. attenuatum* is closest to *C. paucinervatum* (Fée) C. Chr., from which it differs by having the veins forked from the base and the sporangia consequently occupying the upper vein only, while in *C. paucinervatum* the veins are forked near the center of the sporangia-bearing portion.[1] More superficially, the sori of *C. attenuatum* are not consistently confluent, as in *C. paucinervatum*, and the upper fertile portion is never conduplicate.

It is probable that some of the specimens cited by Christensen[2] as *C. furcatum* belong with the present species. Of those I have had opportunity to examine, through the courtesy of Dr. Maxon, *im Thurn 166* and *365*, from Mt. Roraima, show the same type of venation as *C. attenuatum*, while the following specimens show the simple venation which is typical of *C. furcatum:* Trinidad, *Hombersley 277;* British Guiana, Herb. Jenman without number (U. S. Nat. Herb. no. 833006); Brazil, *Spruce 2452*, *Glaziou 12368*.

ELAPHOGLOSSUM LATIFOLIUM (Sw.) J. Sm. South bank of the Caño Negro, Savanna Hills, 4400 ft., *854*. A species of wide American distribution, which future study will probably prove to be an aggregate.

The following specimens were not referred: *381*, sterile (deformed), possibly *Lindsaya; 888*, sterile, *Polypodium? Blechnum?*

[1] See illustration by Goebel in Flora **117**: 118; fig. 10, 11. 1924.

[2] Dansk Bot. Ark. **6**[3]: 20. 1929.

GLEICHENIACEAE[1]

Species of Mount Duida

DICRANOPTERIS FLEXUOSA (Schrad.) Underw. Dry slopes of Savanna Hills, 4400 ft., *744;* Ridge 15, 6600 ft., *599*. Distributed throughout tropical America. No. *744* is very typical; *599* is more fragmentary, but doubtless belongs here also.

SCHIZAEACEAE[1]

Lowland species

ACTINOSTACHYS PENNULA (Sw.) Hook. Tree Savannas, Esmeralda, *326*. Common throughout eastern South America.

ANEMIA BUNIIFOLIA (Gardn.) Moore. Under rocks, slopes of Esmeralda Ridge, *231*. A rarely collected plant, probably distributed throughout the lowlands drained by northern tributaries of the Amazon.

Species of Mount Duida

LOPHIDIUM ELEGANS (Vahl) Presl. Woods, Laterite Valley, Savanna Hills, 4400 ft., *725*. A very variable species throughout the American tropics.

LYCOPODIACEAE[1]

Lowland species

LYCOPODIUM CERNUUM L. New Savanna, Esmeralda, *358;* the common tropical species.

LYCOPODIUM (sterile). East swamp, Esmeralda, *249*, probably sect. *Selago;* East Swamp, Esmeralda, *254*, sect. *Selago*, a species close to *L. portoricense* Underw. & Lloyd.

SELAGINELLA FLABELLATA (L.) Spring. Woods at Foothills Camp, 750 ft., *376*. Distribution, tropical America.

SELAGINELLA RADIATA (Aubl.) Baker. Manáos, *47;* rocky top of Esmeralda Ridge, *201;* tree savannas, Esmeralda, *327;* a species of tropical America from Costa Rica and Guiana to Peru. The present specimens have regular and rather elongate branches.

SELAGINELLA PARKERI (Hook. & Grev.) Spring. Woods at Foothills Camp, 750 ft., *1007*. A species of Guiana and the Amazon basin.

SELAGINELLA CALCARATA A. Br. River banks and flood sands, Muyrapenima, Rio Negro, Brazil, *56*. Distribution, in lowlands on the northern part of the continent; apparently rare.

Species of Mount Duida

LYCOPODIUM CERNUUM L. Crest of Ridge 25, 6300 ft., *407;* the common tropical species.

[1] By Albert C. Smith.

LYCOPODIUM IULIFORME Underw. & Lloyd. Slopes of Ridge 25, 5500–6000 ft., *406;* previously known only from Mt. Roraima. Although the description of this species[1] says "sporophylls 8-ranked," one strobilus of the type specimen shows them 4-ranked, while a strobilus of *Tate 380* from the type locality shows them 6-ranked. The present specimen has sporophylls both 4- and 6-ranked.

Lycopodium duidae A. C. Smith, sp. nov. Caule procumbente, folioso; foliis lanceolato-acuminatis, integerrimis, ipsis facierum inferiorum adpressis, membranaceis, ipsis facierum superiorum extensis, subcoriaceis; ramis adscendenti-erectis, cylindraceis,foliosis, foliis adpressis, lanceolato-linearibus, acuminatis; strobilis apice ramulorum terminalibus, solitariis; sporophyllis lanceolatis, basi rotundatis, apice longe acuminatis, margine irregulariter ciliatis; sporangiis reniformibus, in axillis sporophyllorum sitis.

Plant terrestrial, stem creeping, with upright monostachyous branches; creeping stems cylindric, about 2 mm. in diameter; leaves 8–12-ranked, lanceolate-acuminate, 4–6 mm. long, about 0.7 mm. across the base, midrib obscure, margin entire, those of the lower surface appressed, colorless, membranaceous, those of the lateral and upper surfaces spreading, somewhat secund, subcoriaceous; erect branches cylindric, about 14 cm. high (exclusive of strobili), about 1.3 mm. in diameter, uniformly leafy with 6-ranked appressed linear-lanceolate long-acuminate subcoriaceous leaves 6–7 mm. long, about 0.8 mm. across the base, the margins entire and incurved, often touching; strobili about 4.5 cm. long, 1.5 cm. in diameter (including the wide-spreading sporophylls); sporophylls lanceolate, 8-ranked, about 7 mm. long, 2 mm. broad near the base, tapering to a long-acuminate apex, subcoriaceous at the center, membranaceous at the irregularly ciliate margins, the base rounded to a membranaceous attachment 1 mm. long and 1 mm. broad; sporangia reniform, about 1.2 mm. broad, attached near the base of the inner surface of the sporophyll.

Central Camp, 4800 ft., *1010*. It is a species allied to *L. iuliforme* Underw. & Lloyd and *L. Tatei* A. C. Smith, both found on Mt. Roraima and the former on Mt. Duida as well. The present species has sporophylls less crowded, more noticeably ciliate, longer, and more lanceolate than *L. iuliforme*. It is distinguished from *L. Tatei* by having cylindric rather than flattened creeping stems, longer erect branches, and sporophylls which are larger particularly as regards the basal attachment. *L. iuliforme* has more regular and compact appearing strobili than either of its allies.

Selaginella Tyleri A. C. Smith, sp. nov. Caulibus ubique radicantibus; ramis simplicibus vel ramosis; foliis facierum inferiorum subimbricatis, ovatis, utrinque pilosis, inaequilateralibus, apice acutis, basi cuneatis, margine membranaceis et ciliatis; foliis facierum superiorum similibus, minoribus; spicis apice ramulorum terminalibus; sporophyllis imbricatis, ovatis, utrinque parce

[1] Bull. Torr. Club 33: 120. 1906.

pilosis, apice breve acuminatis, margine ciliatis; sporangiis in axillis sporophyllorum sitis.

Plants suberect, up to 15 cm. high, forming a mat; rhizophores several from the base of the shoots; stem (including leaves) 3–4 mm. broad (exclusive of leaves 0.5–0.8 mm. in diameter), branched at intervals of 3 to 6 mm., branches many, those towards the base short and simple, those towards the apex branched once or twice more; leaves of the lower plane spreading, close, sometimes slightly imbricate, yellowish green, firm, ovate, about 1.8 mm. long and 0.8 mm. broad, ventriculose near the base of the upper edge, acute at the apex, cuneate at the base to a short ligulate attachment about 0.2 mm. broad, the margins narrowly membranaceous, entire, fringed with about 50 persistent unicellular colorless hairs 0.12–0.3 mm. in length, longest on the upper margin near its base, midvein broad, plane on the ventral surface, slightly raised on the dorsal, both surfaces with scattered hairs similar to those of the margins, those of the dorsal surface longer and fewer than those of the ventral surface; leaves of the upper plane the same shape and texture, about 1.1 mm. long and 0.6 mm. broad, ventriculose near the base of the lower edge, short acuminate at the apex, the cilia not exceeding 0.26 mm. in length; spikes short (not exceeding 5 mm. in length), square, about 2.5 mm. in diameter (including the sporophylls), not sharply differentiated from the sterile portion; sporophylls imbricate, resembling the sterile leaves, ovate, about 1.3 mm. long and 0.8 mm. broad, short-acuminate at the apex, narrowed at the base to 0.15 mm., the marginal cilia abundant, about 0.2 mm. long, very sparsely pubescent on the surfaces, the ventral surface strongly concave; sporangia large, with a membranous and nearly colorless envelope, attached near the base of the sporophyll; megasporangia tetrahedral, about 0.7 mm. average diameter, megaspores 4, pale yellow, about 0.4 mm. in diameter, rugose; microsporangia ovoid, about 0.5 mm. by 0.65 mm., microspores abundant, pale orange, about 0.035 mm. in diameter.

Slopes of Ridge 24, beneath rock, 5600 ft., *463*. A species belonging to the group of *S. atroviridis* Spring, allied to *S. Martensii* Spring, *S. vernicosa* Baker, etc., but easily recognized by its striking and persistent pubescence.

Selaginella duidae A. C. Smith, sp. nov. Caulibus basi reclinatis, supra adscendentibus, parce radicantibus; foliis facierum inferiorum extensis, glabris, ovatis, inaequilateralibus, apice subacutis, basi rotundatis et sessilibus, margine superiore serratis, margine inferiore integerrimis; foliis facierum superiorum similibus, minoribus, apice acuminatis, margine toto serratis; spicis apice ramulorum terminalibus, sporophyllis imbricatis, triangulari-ovatis, sulcatis, glabris, apice acuminatis, margine serratis; sporangiis in axillis sporophyllorum sitis.

Stems decumbent at the base, then ascending, up to 15 cm. high; rhizophores several from the base of the shoots, 0.2 mm. in diameter; stem (includ-

ing leaves) 3.5–4 mm. broad (exclusive of leaves 0.4–0.7 mm. in diameter), sparsely branched; leaves of the lower plane spreading, spaced (6 to 8 per centimeter), dull green, firm, glabrous, ovate, 1.3–2 mm. long, 0.65–0.9 mm. broad, ventricose on the upper edge, subacute at the apex, rounded to the sessile base, the upper margin serrate with about 15 cartilaginous apiculate teeth (not exceeding 0.05 mm. in length), the lower margin entire, both surfaces plane, the ventral somewhat concave; leaves of the upper plane hardly imbricate, of the same texture as the larger leaves, ovate, 0.9–1.3 mm. long, 0.4–0.65 mm. broad, ventriculose at the base of the lower edge, acuminate at the apex, rounded at the sessile base, the margins serrate with minute cartilaginous apiculate teeth (about 10 to a side, not more than 0.03 mm. long); spikes 4–6 mm. long, square, about 3 mm. in diameter (including the sporophylls); sporophylls imbricate, of the same texture as the sterile leaves, triangular-ovate, strongly sulcate, about 1.4 mm. long and 0.75 mm. broad, acuminate at the apex, rounded at the base, the margins serrate with minute apiculate teeth (about 20 to a side, not more than 0.03 mm. long), the ventral surface strongly concave, bearing the sporangia at its base; sporangia with a colorless membranous envelope; megasporangia tetrahedral, about 0.6 mm. in diameter, megaspores pale yellow, rugose, about 0.3 mm. in diameter; microsporangia ovoid, about 0.6 mm. by 0.4 mm., microspores abundant, yellow, about 0.03 mm. in diameter.

Laterite Valley, Savanna Hills, 4400 ft., *839*. It is a species with few branches and spreading, rather distant, leaves which are serrate only on the upper margin, in habit resembling *S. vernicosa* Baker.

Selaginella microdonta A. C. Smith, sp. nov. Caulibus laxis, reclinatis, parce radicantibus; foliis facierum inferiorum extensis, orbiculari-ovatis, glabris, apice subacutis, basi rotundatis et sessilibus, margine callosis et minute serratis; foliis facierum superiorum ovatis, glabris, apice acutis, basi rotundatis vel cordulatis, sessilibus, margine minute serratis; spicis apice ramulorum terminalibus; sporophyllis imbricatis, triangulari-ovatis, sulcatis, glabris, apice acutis, basi rotundatis, margine minute serratis; sporangiis in axillis sporophyllorum sitis.

Stems lax, decumbent, up to 14 cm. long; rhizophores several towards base of stems, 0.1 mm. in diameter; stem (including the leaves) 3.5–4 mm. broad (exclusive of leaves 0.2–0.3 mm. in diameter), sparsely branched; leaves of the lower plane spreading, about 7 per centimeter, membranaceous, glabrous, orbicular-ovate, 1.8 mm. long, 1.6 mm. broad, subacute at apex, rounded to the sessile base, margins thickened, slightly revolute, faintly serrate to base (teeth apiculate, about 30 per side), surfaces plane; leaves of the upper plane not imbricate, of the same texture as the larger leaves, ovate, 0.8 mm. long, 0.5 mm. broad, subventricose at base of the lower edge, acute at apex, rounded or cordulate at the sessile base, margins faintly serrate (teeth minute, about

15 per side); spikes 4–7 mm. long, about 2.5 mm. in diameter (including the sporophylls); sporophylls imbricate, of the same texture as the sterile leaves, triangular-ovate, sulcate, about 1.5 mm. long and 0.8 mm. broad, acute at apex, rounded at base, margins faintly serrate (teeth minute, about 25 per side), the ventral surface strongly concave, bearing the sporangia at its base; sporangia with a colorless membranous envelope; megasporangia tetrahedral, about 0.5 mm. in diameter, megaspores pale yellow, 0.25 mm. in diameter; microsporangia ovoid, about 0.6 mm. by 0.4 mm., microspores abundant, minute.

In creek bed, Provisional Camp, slope of Ridge 24, 6000 ft., *509*. It is a species allied to the preceding, but with the leaves more broadly ovate, thick-margined, more membranous in texture, serrate on both margins, and smaller (especially those of the upper plane).

SELAGINELLA RADIATA (Aubl.) Baker. At Agüita, 3100 ft., *890*. A species of tropical America from Costa Rica and Guiana to Peru.

Selaginella scalariformis A. C. Smith, sp. nov. Caulibus basi reclinatis, supra rigide suberectis, parce radicantibus; foliis facierum inferiorum extensis, horizontalibus, coriaceis, glabris, olivaceis, ovatis, inaequilateralibus, apice acutis, basi rotundatis et sessilibus, margine irregulariter minute serratis; foliis facierum superiorum similibus, apice breviter acuminatis; spicis regularibus, robustis; sporophyllis imbricatis, triangulari-ovatis, apice acutis, basi truncatis, margine serratis; sporangiis in axillis sporophyllorum sitis.

Plants stiffly suberect, 4–7 cm. high, growing on dry rocks; rhizophores many from the base of the shoots, stout (about 0.25 mm. in diameter); stem (including leaves) 1.3–2.5 mm. broad (exclusive of leaves 0.4–0.5 mm. in diameter), simple or with a few short branches; leaves of the lower plane spreading, close, horizontal, stiff-coriaceous, concave, olive green, glabrous, ovate, about 1.3 mm. long and 0.75 mm. broad, ventriculose near the base of the upper edge, acute at the apex, rounded to the sessile base, the margins narrowly membranaceous and irregularly serrate with minute apiculate teeth (less than 0.04 mm. in length); leaves of the upper plane the same shape and texture, imbricate, about 0.9 mm. long and 0.5 mm. broad, ventriculose near the base of the lower edge, short-acuminate at the apex, irregularly serrate with membranous teeth (up to 0.06 mm. long, sometimes slightly piliform); spikes regular, up to 6 mm. in length (rarely to 10 mm.), square, somewhat stouter than the contracted sterile branch immediately beneath, about 2 mm. in diameter (including the sporophylls); sporophylls crowded, imbricate, triangular-ovate, about 1.5 mm. long and 0.9 mm. broad, strongly concave, acute at the apex, truncate at the base to a short ligulate attachment about 0.18 mm. broad, the margins regularly serrate with membranaceous triangular apiculate teeth about 0.05 mm. long; sporangia large, with a yellowish membranous envelope, attached at the base of the sporophyll; megasporangia

tetrahedral, about 0.6 mm. in diameter, megaspores not observed; microsporangia ovoid, about 0.6 mm. by 0.5 mm., microspores abundant, yellow, about 0.04 mm. in diameter.

Gorge of the Caño Negro, Savanna Hills, 4000 ft., *817;* a stiff, few-branched plant, marked by its horizontal sessile leaves and comparatively large sporophylls. Probably it is best placed in the group of *S. radiata.*

PODOCARPACEAE

Species of Mount Duida

PODOCARPUS RORAIMAE Pilger. Summit of Peak 7, 7100 feet, *659.* The species has been known hitherto only through its original collection by Ule at similar altitudes on Mount Roraima.

GRAMINEAE[1]

Lowland species

ERAGROSTIS BAHIENSIS Schrad. Yucabí, on the Rio Negro, northern Brazil, *974;* grassy hills and plains, Brazil to Bolivia and Argentina.

ARISTIDA TORTA (Nees) Kunth. Grassy savannas bordering sandstone ridges, Esmeralda, *172;* open or brushy slopes or campos, British and French Guiana, Venezuela, and Brazil.

LEPTOCORYPHIUM LANATUM (HBK.) Nees. Grassy savannas bordering sandstone ridges. Esmeralda, *174;* pine barrens and open or brushy savannas, Mexico and the West Indies to Argentina.

OLYRA LATIFOLIA L. Middle Camp, Esmeralda, *344;* woodlands, Mexico and the West Indies to Bolivia and Brazil.

RADDIA NANA (Döll) Chase. Rocky top of Esmeralda Ridge, *1004;* moist banks, Trinidad, British Guiana, Venezuela, and Brazil.

ANDROPOGON SELLOANUS (Hack.) Hack. Grassy savannas bordering sandstone ridges, Esmeralda, *173;* open savannas, West Indies to Bolivia and Argentina.

Species of Mount Duida

CHUSQUEA WEBERBAUERI Pilger. Summit of Peak 7, 7100 ft., *651;* mountain meadows and paramos, Venezuela, Colombia, and Peru.

Three sterile specimens of bamboos from the summit of the mountain, *678*, *687*, and *714*, could not be satisfactorily identified.

ECHINOLAENA INFLEXA (Poir.) Chase. Dry ridge tops, Savanna Hills, 4400 ft., *804;* brushy slopes and savannas, British and French Guiana, Venezuela, Colombia, and Brazil.

[1] By Jason R. Swallen.

PASPALUM CONTRACTUM Pilger. Dry slopes of Savanna Hills, 4400 ft., *742;* open stony slopes and savannas, Panama to Colombia and Brazil.

PANICUM OBOVATUM Döll. Gorge of Caño Negro, Savanna Hills, 4000 ft., *812;* Venezuela and Brazil (Rio Negro).

Panicum curvifolium Swallen, sp. nov. Perenne; culmi erecti robusti 105–130 cm. alti; folia fere basi aggregata, curvata; vaginae dense pilosae, laminae planae, rigidae, erectae, pungentes, basi dense pilosae, apice glabrae vel scabrae, 40–50 cm. longae, 5–12 mm. latae; ligula obsoleta; panicula 10–12 cm. longa, 12 cm. lata, ramis adscendentibus vel latis expansis; spiculae 2.2 mm. longae, glabrae; gluma prima acuta 1.5 mm. longa; palea sterilis lemmati sterile aequilonga.

Perennial, culms stout, erect, 105–130 cm. tall; leaves mostly crowded toward the base, the upper ones of the basal cluster stiffly erect, the lower ones becoming brown and much curled with age, culm leaves one or two, distant, reduced; sheaths loose, very densely pilose with stiff hairs except those of the culm, these pilose below or nearly glabrous; blades 40–50 cm. long, 5–12 mm. wide, thick and firm, narrowed toward the base, the juncture with the sheath inconspicuous, more or less involute toward the pungently pointed tip, densely pilose on both surfaces toward the base, becoming glabrous or scabrous toward the tip, the margins scabrous; ligules obsolete; panicles pyramidal, 10–12 cm. long, 12 cm. wide, the branches stiffly ascending to widely spreading; spikelets 2.2 mm. long, glabrous; first glume acute, about half the length of the spikelet; second glume and sterile lemma equal, the latter enclosing a well developed palea as long as the sterile lemma; fruit 2 mm. long, pointed, golden yellow, smooth and shining.

Moist slopes of Savanna Hills, 4400 ft., *776*. The species is allied to *Panicum chnoodes* Trin., but differs in the coarser aspect, the smaller spikelets, and the obsolete ligule.

Panicum Tatei Swallen, sp. nov. Perenne; culmi erecti vel adscendentes, 30–50 cm. alti; laminae laeves, rigidulae, pungentes, subinvolutae, 10–20 cm. longae, 2–4 mm. latae; ligula obsoleta; panicula densa 6–10 cm. longa, 2–4 cm. lata, ramis anguste adscendentibus; spiculae 2.2 mm. longae; gluma prima 1.5 mm. longa, acuta, 1–3-nervia; palea sterilis lemmati sterili aequilonga.

Fig. 2. *Panicum Tatei*, spikelet ×10.

Perennial; culms erect or ascending, 30–50 cm. tall; leaves crowded toward the base, smooth throughout; sheaths loose, sometimes sparsely ciliate on the margins; blades firm, folded, pungently pointed, 10–20 cm. long, 4–6 mm. wide; ligule obsolete, the juncture of the sheath and blade obscure; panicles rather dense, 6–10 cm. long, 2–4 cm. wide, more or less enclosed in the upper leaves, the branches narrowly ascending, spikelet-bearing from above the middle; spikelets 2.2 mm. long; glumes and sterile lemma acute, scabrous on the keels; first glume 1–3-nerved, somewhat clasp-

ing, 1.5 mm. long; second glume and sterile lemma equal, 5-nerved, diverging at maturity, exposing the fruit; sterile palea well developed, as long as the sterile lemma; fruit 2 mm. long, yellowish, smooth and shining (Fig. 2).

Near summit of Ridge 25, 6000 ft., *524*, *1030* (type). This species is allied to *Panicum loreum* Trin., but differs in being glabrous and in the absence of a ligule. In occasional spikelets there are two sterile lemmas, the lower one of which is without a palea.

RADDIA NANA (Döll) Chase. Rocks above Caño Negro, Savanna Hills, 4200 ft., *820;* moist banks, Trinidad, British Guiana, Venezuela, and Brazil.

CYPERACEAE[1]

Lowland species

CYPERUS HASPAN L. East swamp at Esmeralda, *247;* widely distributed in the American tropics from the southern United States to Brazil.

DICHROMENA CILIATA Vahl. Santa Isabel on the Rio Negro, *104;* West Indies and Mexico to Brazil and Bolivia.

DIPLAZIA KARATAEFOLIA L. C. Rich. S˜o Sebastian on the Rio Casiquiare, *156;* a striking species of the Amazonian forests, ranging from Trinidad to Bolivia.

ELEOCHARIS sp. East Swamp at Esmeralda, a juvenile plant, *258*.

LAGENOCARPUS (?) RIGIDUS Nees. East swamp at Esmeralda, *238;* also known from central Brazil.

LAGENOCARPUS (?) sp. Rocky top of Esmeralda Ridge, *191*.

PSILOCARYA CANDIDA Nees. East Swamp at Esmeralda, *256;* also known from British Guiana.

PSILOCARYA sp. Grand Savanna at Esmeralda, *296*.

RYNCHOSPORA BARBATA (Vahl) Kunth. East Swamp and grassy meadows at Esmeralda, *171*, *260;* widely distributed in tropical America from Hayti to Colombia and northern Brazil.

RYNCHOSPORA CEPHALOTES (L.) Vahl. Muyrapenima on the Rio Negro, *64;* Cuba and Central America to Brazil.

RYNCHOSPORA GLOBOSA (HBK.) R. & S. Dry savannas at Esmeralda, *278;* Mexico and Cuba to Brazil and Bolivia.

RYNCHOSPORA sp. East Swamp at Esmeralda, *240*, *243*.

STENOPHYLLUS JUNCIFORMIS (HBK.) Britt. Grassy meadows at Esmeralda, *170;* rocky top of Esmeralda Ridge, *204*. The species ranges from Cuba and Mexico to Bolivia and Brazil.

[1] By N. L. Britton.

Stenophyllus lanatus (HBK.) Britt. nov. comb. *Isolepis lanata* HBK. Nov. Gen. & Sp. 1: 220. pl. 68. 1816.

Savannas and rocky places at Esmeralda, *185, 205, 279, 951;* also known from the Guianas.

Species of Mount Duida

EVERHARDIA (?) MONTANA Ridley. Summit of peak 7, 7100 ft., *638.* The type and only other known station is Mount Roraima.

EVERHARDIA spp. Other material of this genus, apparently endemic to the mountains from Duida to Roraima, may represent three or even four undescribed species, but is not in good condition and is consequently left undescribed. Here are included numbers *469, 542, 720, 721, 800,* and *816,* from altitudes between 4000 and 6800 feet.

LAGENOCARPUS (?) RIGIDUS Nees. Ridge northwest of Vegas Brook, *570.*

LAGENOCARPUS sp. Savanna Hills, 4400 ft., *1040.*

RYNCHOSPORA sp. Savanna Hills, 4400 ft., *746.*

SCLERIA CYPERINA Kunth. Savanna Hills, 4500 ft., *738;* Venezuela and Bolivia.

STENOPHYLLUS sp. Savanna Hills, 4400 ft., *799.*

PALMAE[1]

Lowland species

GEONOMA BACULIFERA (Poit.) Kunth. Left bank of the Rio Casiquiare at Quemapure, *166;* bekannt von Guayana bis Pará.

Geonoma chaunostachys Burret, sp. nov. Palma acaulis, 3 m. alta. Petiolus ad apicem supra 0.5 cm. latus, plus minus fusco-leprosus, glabrescens. Rachis 60 cm. longa, subtus fusco-leprosa. Lamina inter firmiores, i. s. utrinque fere concolor, nervis primariis utrinsecus 22, basi sat anguste nonnihil cuneatim protracta, sed non in petiolum decurrens, frondis unius visae 90 cm. circ. longa, in altero latere indivisa, in altero segmentis 3. Segmenta 4–7 cm. dissita, 4–6, 5 cm. lata, porrecta, vix falcata, apice anguste acuminata, praeter apicalia subito contracta, apicalia 30 cm. fere longa. Nervi primarii subtus valde prominentes, ardui, in dimidia lamina angulo 30° rachin petentes, versus quam paulo curvati, inferiores angulo etiam acutiore ascendentes. Nervi secundarii subtus ejusdem circ. valitudinis, primo visu vix distinguendi, sed paulo latiores. Inter primarium et secundarium tertiarii nonnulli, utrinque, subtus melius conspicui. Spadix simplex, ut videtur, longe pedunculatus. Pedunculi fragmentum visum 29 cm. longum, inferne applanatum. Spica fructifera apice destructa circ. 11 cm. longa. Axis inter tenuiores, in internodis 4 mm. in diam., i. s. atrofusca, granulosa. Foveae laxe, in dimidia spica fere regu-

[1] By M. Burret.

lariter ad 3 in verticillis alternantibus, in orthostichis 6 dispositae, ejusdem orthostichae sequentes 7 mm. inter partes aequales dissitae, bilabiatae. Labium superius ab axi conspicue protractum, inferius incisum. Fructus i. s. nigri, ovales, 9×7 mm., densissime, minutissime granulosi. Pericarpium 0.75 mm. in diam. Semen 6–5.5×5 mm.

Slopes of Mount Duida, 750 ft., *394*. Die Art schliesst sich am besten an *G. Brongniartii* Mart. an, unterscheidet sich jedoch durch die kräftigere Kolbenähre, die bedeutend grösseren Früchte, die steileren Nerven, und die ziemlich lang keilförmige Blattbasis.

GEONOMA HEXASTICHA Spruce. Forest at Middle Camp, Esmeralda, *355*. Von der genannten Art, die von Spruce am oberen Rio Negro gesammelt wurde, liegt mir zur Zeit nur eine Photographie vor. Zu vergleichen ist hiermit auch *G. maxima* (Poit.) Kunth, die mir nicht ausreichend bekannt ist.

The following specimens are sterile: *Geonoma* sp. Forest at Middle Camp, Esmeralda, *350; Bactris* sp. Buena Vista on the Rio Casiquiare, *157; Catoblastus* sp. Forest at Middle Camp, Esmeralda, *349; Lepidocaryum* sp. Acaulescent, a foot high, Esmeralda, *242; Maximiliana* sp. Forest at Middle Camp, Esmeralda, *356*.

Species of Mount Duida

Euterpe montis-Duida Burret, sp. nov. Palma 20 pedes alta. Caudex tenuis, 3 cm. circ. in diam. metiens, annulis densis, 1 cm. vix dissitis. Frondis rachis plus minus glabrata, parce atro-leprosa. Segmenta, ut videtur, subhorizontaliter patentia, rachi oblique spatiis regularibus in eadem planitie inserta, frondis fragmenti parvi visa 50 cm. fere longa, anguste nonnihil acuminata, a dimidio inferne conspicue angustata, nervis majoribus praeter marginales dextra sinistra 2, tenuibus subtus conspicuis plurimis percursa, subtus trichomatibus minutissimis, brunneis sub lente forti densiuscule punctata. Spadix parvus. Pedunculus 9 cm. circ. longus, i. s. apice 1 cm. in diam. Spathae superioris annulus 2.5 cm. a ramo infimo dissitus, tertia incompleta interposita oblongo-lanceolata, 5.5 cm. longa, 1 cm. lata, tenuis, intus glabra, extus fere glabrata, fusco-leprosa; supra hanc bracteam ulterior sterilis elongato-triangularis, 1 cm. longa. Rami infimi bracteis triangularibus, pro rata nonnihil evolutis, bracteae superiores diminuentes. Rachis 21 cm. longa, ut rami indumento brevi i. s. sordide brunneo-flavo densissime obtecta, pilis oculo inermi inconspicuis, tactu haud sensibilibus. Rami numerosi, inter minus validos, majores circ. 40 cm. longi, ad florum glomerulos subflexuosi, longitudinaliter angulosi. Glomeruli usque ad dimidium ramum floribus 3, masculis 2 femineo superpositis, supra plerumque floribus 2. Flores masculi non visi, feminei ovati glabri.

Slopes of Ridge 25, 5500–6000 ft., *452*. Leider liegt die Art in einem ungünstigen Stadium vor, indem weder Früchte noch männliche Blüten

vorhanden sind. Von den bisher bekannten Arten kommt nur *E. longibracteata* Barb. Rodr. in Betracht, an die sie nach deren Abbildung und Beschreibung am besten anzuschliessen ist. Die Brakteen sind hier weniger stark entwickelt. Bei *E. longibracteata* ist die Behaarung des Kolbens in trockenen Zustand wahrscheinlich weiss, bei *E. montis-Duida* bräunlich gelb. Nach Beschreibung und Abbildung ist bei *E. longibracteata* immer nur eine männliche Blüte über der weiblichen inseriert, während hier wenigstens bis zur Mitte der Äste regelmässig Blütentriaden vorhanden sind. In der Anordnung und Beschaffenheit der Fiedern vermag ich keinerlei Unterschiede festzustellen. Jedoch ist nach den vorhandenen Stammstücken dieser bei *E. montis-Duida* ganz bedeutend dünner.

Bei dieser Gelegenheit möchte ich bemerken, dass ich in Engl. Bot. Jahrb. **53:** 52 den Stamm von *E. longibracteata* durch ein Versehen mit 7–8 m. anstatt 4–5 m. angegeben habe.

GEONOMA sp. Near summit of Peak 7, 7050 ft., *679*, growing ten feet high, sterile.

CYCLANTHACEAE

Lowland species

CARLUDOVICA sp. A sterile plant, described as an epiphyte 30 feet long, was collected at Foothills Camp, lower slopes of Mount Duida, *382*.

Species of Mount Duida

CARLUDOVICA sp. Leaves of a small plant three feet high were collected at Central Camp, 4800 ft., *573*, and fruiting peduncles of another at Desfiladero, 6000 ft., *697*.

CYCLANTHUS BIPARTITUS Poit. Growing ten feet high at Agüita, 4000 ft., *907*. The species occurs from the West Indies to Peru.

ARACEAE

Lowland species

ANTHURIUM HOOKERI Kunth. Rocky top of Esmeralda Ridge, *189*. The species has been known from the Lesser Antilles to the Guianas: the present record is a considerable extension of its range.

SPATHIPHYLLUM CANNIFOLIUM (Dryand.) Schott. In stream gravel, woods at Foothills Camp, base of Mount Duida, 750 ft., *390;* common throughout northern South America.

Species of Mount Duida[1]

ANTHURIUM QUINQUENERVIUM Kunth. Slopes of Ridge 25, 5100 ft., *474;* terrestrial, 4 ft. high, erect, bracts yellow-green. The only previous collection is that of Humboldt in the Andes of Pasto.

[1] By K. Krause.

ANTHURIUM RORAIMENSE N. E. Br. South Bank of the Caño Negro, Savanna Hills, 4400 ft., *855;* also on Mount Roraima. The plant was collected without flowers, but I think it belongs to this species.

PHILODENDRON MACROGLOSSUM Schott. On rocks, Savanna Hills, 4400 ft., *831;* known only from Venezuela.

Philodendron Tatei Krause, sp. nov. Planta terrestris. Foliorum petiolus ignotus; lamina magna rigida crasse coriacea elliptica apice breviter acuminata basin versus subrotundatus ima basi paullum decurrens, 4.3 dm. longa, fere 3 dm. lata, nervis lateralibus primariis 12–14 supra impressis subtus distincte prominentibus angulo circ. 60–70° costa valida subtus praesertim basin versus valde prominente abeuntibus prope marginem arcuatim adscendentibus venis secundariis tenuioribus primariis parallelis percursa. Pedunculus teres validus, circ. 5 cm. longus, siccus 5 mm. crassus. Spathae carnosae in siccitate obscure brunneae tubus late ovoideus 5 cm. longus, 4–5 cm. latus, lamina anguste lanceolata, apice breviter acuminata, 10–12 cm. longa, inferne expansa 3–4 cm. lata sursum attenuata. Spadicis brevissime stipitati in siccitate brunnei inflorescentia feminea in statu maturescente oblongo-ellipsoidea, circ. 4.5 cm. longa, fere 3 cm. crassa, pars sterilis brevis vix contracta, inflorescentia mascula anguste conoidea apice acuta, circ. 10 cm. longa, inferne 1–1.2 cm. crassa, sursum sensim attenuata. Pistilla oblonga, vertice truncata, stigmate vix elevato coronata, 5–6 mm. longa, 2 mm. lata; ovula numerosa. Flores masculi plerumque 4–5-andri; stamina prismatica vertice truncata, 3–4 mm. longa.

Savanna Hills, 4400 ft., *845*. The large, thickly coriaceous leaves are very characteristic for this beautiful species, which resembles *P. longipes* Engl. and *P. graveolens* Engl., both from Colombia.

PHILODENDRON sp. On rocks, Savanna Hills, 4400 ft., *830*. The plant has very characteristic, thickly coriaceous leaves, the basal lobes of which are largely connivent. It is certainly a new species, but without flowers it is too incomplete for description.

STENOSPERMATIUM sp. Three feet tall, spathes white: Agüita Slope, 3500 ft., *702*.

MAYACACEAE

Lowland species

MAYACA FLUVIATILIS Aubl. In the water of East Swamp, Esmeralda, *272*. This is probably the commonest species of the genus, ranging from the southern United States southward throughout tropical America.

MAYACA SELLOWIANA Kunth. In open sandy swamp, Camanaos, on the Rio Negro, northern Brazil, *120;* East Lake at Esmeralda, *251*. Tropical South America.

XYRIDACEAE[1]

Lowland species

XYRIS LONGICEPS Malme. Swampy ground, Grand Savanna, Esmeralda, *301;* also known from Surinam.

XYRIS SAVANNENSIS Miq., Sandy swamp, top of Esmeralda Ridge, *215;* Guiana, Venezuela, and Colombia, south to Rio Grande do Sul, Paraguay, and Bolivia.

XYRIS LACERATA Pohl. Wet or open savanna, Esmeralda, *184, 263;* Colombia, Venezuela, Matto Grosso, and Goyaz.

Xyris subglabrata Malme, sp. nov. Subbulbosa (vel caespitosa), humilior; scapi recti, subteretes, ecostati, subtiliter transversim rugulosi vel superne laevigati; folia rigida, crassiuscula, complanata, scapo paullo usque duplo breviora, subtiliter transversim rugulosa, aciebus obtusissimis, vagina tertiam vel quartam partem folii occupans, indistincte limitata (ligula nulla), eciliata, deorsum sensim, basi valde dilatata, sordide ferruginea, opaca. Spica satis pauciflora, obovoidea; bracteae coriaceae, integerrimae, fulvae vel fulvo-castaneae, intermediae (fertiles) ovales vel obovatae, apice rotundatae, area dorsali magna, cinereo-viridi, carinata ornatae, steriles paucae, ovatae, obtusae, intermediae saltem duplo breviores; sepala lateralia subaequilatera, lanceolata, acuta, ala carinali angusta, in parte tertia media ciliato-scabridula, apicem versus ciliato-villosa.

Scapi 12–18 cm., raro usque 25 cm. alti, circiter 0.7 mm. crassi; folia 10–12 cm., raro usque 15 cm. longa, circiter 1 mm. lata, acuta vel obtusiuscula, vagina circiter 3 cm. longa; spica 5–7 mm. longa, circiter 4 mm. crassa; bracteae infimae 1.5–2 mm. longae, intermediae 5 mm. longae et 3 mm. latae, area dorsali triangulari-ovata, carina saepissime in mucronem brevissimum excurrente; sepala lateralia libera, circiter 4.5 mm. longa, usque 0.8 mm. lata.

Petals crimped, orange-yellow; in swampy ground, Grand Savanna, Esmeralda, *303.* Affinis, etsi vix arctius, *X. glabratae* Griseb., in Guiana et Trinidad occurrenti, foliis recedenti utroque latere laevibus, vagina laevigata, nitida, scapis altioribus, bracteis infimis spicae longioribus (intermediis paullo, raro fere duplo brevioribus), et carina sepalorum lateralium eciliata vel irregulariter serrulata.

XYRIS LOMATOPHYLLA Mart. Swampy ground, Grand Savanna, Esmeralda, *294;* Amazonas ("in campis montis Araracoara"). Specimina a Tate collecta quam typus altiora et robustiora; folia usque 20 cm. longa, 4–5 mm. lata, vagina 4–5 cm. longa; scapi saltem usque 60 cm. alti, 1.5–2 mm. lati; bracteae spicae superne pilis albidis crispulis ciliatae.

XYRIS ERIOPHYLLA Reichenb. Swampy ground, Grand Savanna, Esmeralda, *304;* Guiana et Amazonas (Colares). Specimina a Tate col-

[1] By G. A. Malme.

lecta a guianensibus recedunt foliis longioribus, usque 33 cm. longis, utraque vel altera acie pilis usque 2 mm. longis, albidis, crispulis ciliatis (demum saepe glabratis), et scapis usque 38 cm. altis, altera acie albido-ciliatis.

XYRIS JUPICAI Rich. Esmeralda, specimen unicum cum no. *245* immixtum; a Maryland et Texas ad Paraguay et Uruguay.

ABOLBODA POEPPIGII Kunth. In running stream in woods, Grand Savanna, Esmeralda, *299;* Pará.

ABOLBODA MACROSTACHYA Spruce. Grand Savanna, Esmeralda, *244;* eodem loco jam a Spruce lecta.

Species of Mount Duida

XYRIS TENELLA Kunth, var. SUBTENELLA Malme. Gorge of Caño Negro, Savanna Hills, 4000 ft., *810*. Quam typus humilior, foliis tantum usque 4 cm. longis, raro usque 1 mm. latis, vix ciliata-scabridulis, scapis tantum usque 18 cm. altis, spica vix 5 mm. longa. Goyaz, Matto Grosso, et Paraguay (formae affines São Paulo, Minas Geraes et Guyana).

Xyris stenophylloides Malme, sp. nov. Caespitosa, gracilis, elata; scapi recti vel flexuosi subteretes, ecostati, laeves, vagina basalis eciliata, inferne ferrugineo-castanea, nitida; folia angustissima, scapo duplo breviora, vulgo spiraliter tortula, laeves; vagina sextam fere partem folii occupans, latiuscula, ligula distincta limitata, eciliata, inferne ferrugineo-castanea, nitida; spica satis multiflora, crasse subturbinata; bracteae tenuisculae, patulae, subintegerrimae, ferrugineae vel badiae, concolores, nitidulae intermediae late oblongae, sub apice rotundata obscure carinatae; sepala lateralia fere aequilatera, subpellucida, lineari-lanceolata, ala carinali subintegerrima, eciliata.

Scapi vulgo 30–40 cm. alti, 0.6–0.8 mm. crassi, vagina basalis vulgo 6–7 cm. longa, subaphylla; folia 15–20 cm. longa, 0.6–1 mm. lata, apice subulata, nervoso-striata, aciebus obtusis, vagina 2–3 cm. longa, jam superne lamina latior, deorsum sensim dilatata; spica vulgo 7–8 mm. longa; bracteae steriles paucae, infimae ovatae, circiter 1.5 mm. longae, fertiles (intermediae) circiter 6 mm. longae, usque 2.5 mm. latae; sepala lateralia libera, leviter curvata, circiter 5 mm. longa et 0.6 mm. lata, ala carinali praecipue superne latiuscula.

Growing in tussocks, gorge of Caño Negro, Savanna Hills, 4000 ft., *808*. Affinis esse videtur *X. stenophyllae* (in Rio de Janeiro, São Paulo, et Paraná occurrenti), quae recedit vagina foliorum pro rata longiore, ciliata, spica pauciflora, bracteis infimis multo longioribus et sepalibus lateralibus latioribus, ala carinali angusta.

Xyris Tatei Malme, sp. nov. Caespitosa, robusta, elata; scapi recti, ancipites, bicostati, laeves; folia rigida, ensiformi-linearia, scapo paullo usque duplo breviora, laevia, aciebus acutis, vagina circiter tertiam partem folii occupans, ligula distincte limitata, eciliata, inferne castanea, nitida; spica multiflora,

obovoideo-subglobosa, basi contracta; bracteae coriaceae, subintegerrimae, castaneae vel brunneae, concolores, nitidae, intermediae (fertiles) late oblongo-ovales, sub apice rotundato obtuse indistincteque carinatae, infimae (steriles) multo breviores; sepala lateralia subaequilatera, lineari-lanceolata, acuta vel acuminata, dorso castanea, ala carinali praecipue superne lata, fere inde a basi ciliata.

Scapi usque 70 cm. alti et 3 mm. lati, folia manifeste disticha, vulgo 35–45 cm. longa, 4–6 mm. lata, eciliata, apice falcato-incurvata et obtusiuscula; vagina 13–15 cm. longa, superne lamina paullulo angustior, deorsum sensim dilatata, carinata; spica 11–13 mm. longa; bracteae steriles numerosae, vulgo multifariam imbricatae, infimae triangulari-semiorbiculares, circiter 1.5 mm. longae, ceterae gradatim majores, fertiles (intermediae) circiter 8 mm. longae, 4–5 mm. latae; sepala lateralia libera, circiter 7 mm. longa, 1–1.25 mm. lata (Pl. 24, Fig. 1).

Moist slopes of Savanna Hills, 4400 ft., *778*, *835* (type). Habitu *Xyri-dem Augusto-Coburgi* Szyszyl. (in Itatiaya et Serra dos Orgãos, Rio de Janeiro, occurrentem) in memoriam revocat, at ei vix arctius affinis. Recedit haec foliis scabrido-ciliatis, vagina pro rata longiore (dimidiam fere partem folii occupante), bracteis spicae angustioribus, obtusis, opacis, sepalis lateralibus inaequilateris, obtusis, etc.

Ad speciem supra descriptam verisimiliter pertinet num. *417* (Slopes of Ridge 25; flower-stalks 3 ft. high; specimen unicum cum spica unica), foliis recedens tenuioribus et brevioribus, usque 6 mm. latis, tantum usque 20 cm. longis, vagina usque 7 cm. longa.

Xyris lugubris Malme, sp. nov. Caespitosa, satis robusta, humilior; scapi recti aliquantulum complanati, ecostati, laeves; folia rigida, ensiformi-linearia, scapo paullo breviora, laevia, aciebus obtusis, vagina circiter tertiam partem folii occupans, ligula distincte lacerata, eciliata, inferne spadicea, nitida; spica multiflora, obovoidea, basi paullum contracta; bracteae coriaceae, apice grosse laceratae nigricantes, concolores, opacae, intermediae (fertiles) ovales vel late oblongae, sub apice rotundato obtuse indistincteque carinatae, infimae (steriles) multo breviores; sepala lateralia anguste lanceolata, acuta, dorso castanea vel subspadicea, ala carinali angusta, in parte dimidia superiore ciliato-scabrida.

Scapi vulgo 20–30 cm. alti, circiter 1.5 mm. lati, folia manifeste disticha, vulgo 16–20 cm. longa, 2.5–3.5 mm. lata, acuta, stomatibus punctulata, eciliata (aciebus nonnunquam indistincte scabridulis), vagina 5–6 cm. longa, superne lamina paullo latior, inferne aliquantulum dilatata; spica 11–13 mm., raro usque 15 mm. longa; bracteae steriles numerosae, infimae ovato-triangulares, 2–3 mm. longae, ceterae gradatim majores, fertiles (intermediae) 7–8 mm. longae, usque 3 mm. latae; sepala lateralia libera, circiter 6 mm. longa, vix 1 mm. lata (Pl. 24, Fig. 1).

Summit of Peak 7, 7100 ft., *639*. Praecedenti affinis, at jam scapo ecostato, bracteis spicae laceratis, nigricantibus, opacis et ala carinali sepalorum lateralium angusta, tantum in parte dimidia superiore ciliata bene distincta.

Xyris atriceps Malme, sp. nov. Caespitosa, gracilis, satis elata; scapi recti, teretes, ecostati, laeves; folia recta vel leviter flexuosa, scapo paullo (usque duplo) breviora, teretia, subfiliformia, laevia, utroque latere sulco longitudinali angusto praedita, vagina circiter octavam partem folii occupans, jam superne lamina latior, eciliata, inferne castanea vel spadicea, nitida; spica satis pauciflora, obovoideo-turbinata, bracteae coriaceae, apice grosse laceratae, spadiceo-nigricantes vel atrae, concolores, opacae, intermediae (fertiles) late ovales vel obovato-ovales, sub apice rotundato obtuse et satis indistincte carinatae, infimae (steriles) fere duplo breviores; sepala lateralia aequilatera, lineari-lanceolata, acuta, castanea, ala carinali angusta, in parte dimidia superiore ciliato-scabridulae.

Scapi saltem usque 50 cm. alti, circiter 0.7 mm. crassi, vagina basalis subaphylla, usque 10 cm. longa; folia saltem usque 35 cm. longa, circiter 0.5 mm. lata, eciliata; vagina 3–4 cm. longa, basin versus sensim dilatata; spica circiter 9 mm. longa, usque 5 mm. crassa; bracteae steriles numerosae, patulae, infimae ovato-triangulares, circiter 2.5 mm. longae, ceterae gradatim majores, fertiles (intermediae) 4.5–5 mm. longae, usque 3.5 mm. latae; sepala lateralia libera, 4–4.5 mm. longa, circiter 0.8 mm. lata.

Forming tussocks, Ridge 15, 6700 ft., *688*. Praecedenti affinis, scapo gracili, foliis teretibus, subfiliformibus et spica magis pauciflora bene distincta.

Xyris Tatei, *X. lugubris*, et *X. atriceps* stirpem peculiarem, st. *Xyridis lugubris*, formant, bracteis spicae coriaceis, concoloribus, obscuris, ala sepalorum lateralium plus minusve ciliata, vagina foliorum breviuscula etc. dignotam, ex altera parte vix dubie stirpi *X. subulatae*, ex altera forsan stirpi *X. spectabilis* affinem. *X. atriceps* forma et structura foliorum a ceteris valde recedit, quoad spicam vero haud multum differt.

Xyris duidensis Malme, sp. nov. Caespitosa, humilis; scapi recti, ancipites, bicostati vel bialatis, in costis ciliato-scabriduli, ceterum laeves; folia ensiformi-linearia, saepe spiraliter torta et flexuosa, scapo vix breviora, acuta, laevia, aciebus paullulum cartilagineis, vagina plus quam dimidiam partem folii occupans, ligula distincta limitata, eciliata, basin versus brunnea vel castanea, nitidula; spica pauciflora, ovoideo-fusiformis; bracteae subcoriaceae, fulvae, opacae, intermediae (fertiles) obovatae, apice rotundatae et vulgo eroso-laceratae, area dorsali magna, carinata, cinereo-viridi vel sordide purpurascente ornatae, steriles paucae (vulgo 4), infimae lanceolatae, acutae, carinatae, apice primitus ciliatae (pilis longis, crispulis); sepala lateralia inaequilatera, lanceolata, acuta, ala carinali superne latiuscula et crebre ciliata.

Scapi vulgo 5–6 cm. alti, circiter 1 mm. lati; folia manifeste disticha, 4–5 cm. longa, 0.9–1.3 mm. lata, aciebus acutiusculis; vagina 3–3.5 cm. longa, basin versus paullum dilatata; spica 4–5 mm. longa, 2–2.5 mm. crassa; bracteae infimae 3–3.5 mm. longae, intermediae aequilongae, (explanatae) usque 2 mm. latae, apice vulgo sordide purpurascentes, area dorsali ovato-lanceolata; sepala lateralia libera, circiter 3 mm. longa, usque 0.9 mm. lata.

Gorge of Caño Negro, Savanna Hills, 4000 ft., *811* (type); streambed at Central Camp, *544*, 4800 ft., with yellow flowers. Species e stirpi *X. guianensis*, arcte affinis *X. rubrolimbatae* Heimerl—ad flumen Guiania (Rio Negro) lectae—quae recedit foliis latioribus, aciebus incrassatis, scapis subteretibus, spica crassiore et sepalis lateralibus linearibus, apice obtusis.

ABOLBODA GRANDIS Miq., var. **rigida** Malme, var. nov. Recedit a typo foliis rigidis, spica majore, bracteis et sepalis lateralibus longioribus.

Folia rigida, 12–17 cm. longa, 8–10 mm. lata, acuta, fere pungentia; scapi usque 85 cm. alti (vulgo tamen humiliores) et 2.5 mm. crassi, vaginis usque 4 cm. longis; spica usque 3.5 cm. longa; bracteae ovato-triangulares vel ovales, circiter 10 mm. longae, usque 5 mm. latae, acuminatae vel mucronatae, sepala lateralia usque 18 mm. longa et 5 mm. lata, acuta.

Scape 3 ft. high; flowers blue-purple, 1 in. in diameter, Brocchinia Hills, 4500 ft., *586* (type); Savanna Hills, 4400 ft., *1041*. Forma primaria: Surinam, Pará, Alto Amazonas (Manáos), Venezuela (ad Rio Negro), tantum in planitie depressa; var. *minor* Malme: Alto Amazonas (Manáos).

ABOLBODA SCEPTRUM Oliver. Folia rigida, 18–25 cm. longa, usque 4 cm. lata, acuta, subpungentia; scapus usque 90 cm. altus (vaginis oppositis nullis?); spica subglobosa vel fere semiglobosa, usque 7 cm. longa; bracteae ovato-triangulares, circiter 2 cm. longae et 1 cm. latae, acutae vel paullulum acuminatae; sepalum medianum (anticum) planum, ovato-lanceolatum, circiter 4.5 cm. longum, usque 1 cm. latum, acuminatum; sepala lateralia subaequilatera, ovato-lanceolata, circiter 5 cm. longa, usque 1 cm. lata, acuta vel acuminata, ala carinali angusta, subintegerrima. (Antherae speciminis e Roraima reportati sublineares, usque 10 mm. longae, circiter 1.5 mm. latae; filamentum anthera duplo longius).

Stems 3 ft. high; flowers yellow; crest of Ridge 25, 6300 ft., *398*. Cum speciminibus e Roraima reportatis bene congruit. Sepalo antico evoluto et corolla flava vel lutea a ceteris hujus generis speciebus recedens; forsitan novum genus sistat.

ERIOCAULACEAE

Lowland species

TONINA FLUVIATILIS Aubl. Along the Casiquiare River, Venezuela, *165;* widely distributed and very common at low altitudes throughout tropical South America.

PAEPALANTHUS FASCICULATUS (Rottb.) Koern. Under rocks on Esmeralda Ridge, *229, 274;* widely distributed and common through tropical America.

SYNGONANTHUS CAULESCENS (Poir.) Ruhl. East Swamp at Esmeralda, *246;* a common plant in tropical South America.

SYNGONANTHUS GRACILIS (Koern.) Ruhl. East Swamp at Esmeralda, *259;* sandy swamp on Esmeralda Ridge, *216;* native of northern South America.

SYNGONANTHUS HUBERI Ruhl. In an open sandy swamp at Camanaos, on the Rio Negro, northern Brazil, *123;* hitherto known only from the type collection from the upper Amazon.

SYNGONANTHUS HUMBOLDTII (Kunth) Ruhl., var. **glandulosus** Gleason, var. nov. A forma typica differt pedunculis molliter glanduloso-villosis; caulibus elongatis gracillimis glabris vel summo puberulis; foliis fasciculatis angustissime linearibus basi lanatis; pedunculis compluribus elongatis.

In moist parts of the Grand Savanna, Esmeralda, *315*. The basal leaves are 15 to 25 mm. long and 3 to 4 times as long as the cauline.

Syngonanthus reflexus Gleason, sp. nov. Caule abbreviato villoso; foliis rosulatis crassis erectis linearibus acutis glabris supra sulcatis subtus rotundatis; vaginis acuminatis dimidium foliorum aequantibus glabris; pedunculis paucis elongatis glabris leviter tortis obscure 9-sulcatis; capitulis mediocribus campanulatis stramineis; bracteis involucrantibus numerosis eleganter spiraliter imbricatis infimis late oblongis interioribus gradatim elongatis intimis oblongo-linearibus, omnibus basi appressis dorso subtomentosis apice in appendicem linearem glabram retroflexam subito acuminatis; petalis florum femineorum linearibus elongatis villosis; stylo breve, stigmatibus 3 simplicibus non appendiculatis.

Stem very short, densely villous among the leaf-bases; leaves rosulate, erect, thick and firm, linear, 50 to 75 mm. long, 1.5 to 2 mm. wide, acute, sparsely villous when young, soon becoming glabrous, deeply sulcate above, rounded beneath, slightly twisted; vaginas about half as long as the leaves, glabrous, slightly dilated above, acuminate; peduncles 2–4, erect, 25–35 cm. tall, slender, glabrous, slightly twisted, shallowly 9-sulcate; heads campanulate, 8 mm. high, including the projecting corollas; outer bracts very numerous, beautifully spirally imbricate in many series, closely appressed and subtomentose on the back at base, abruptly acuminate above into a linear-subulate, glabrous, recurved appendage, the outermost broadly oblong, the inner progressively elongate, the innermost linear-oblong; pistillate flowers: sepals scarious, linear-subulate, 2.5 mm. long, 0.3 mm. wide at base, glabrous; petals scarious, erect, filiform, 4.5 mm. long, densely long-villous throughout, the distal 1 mm. very narrowly lanceolate; ovary ellipsoid, 0.9 mm. long; style straight, 0.5 mm. long; stigmas 3, erect, 1.3 mm. long, filiform, simple; append-

ages none; seeds nearly cylindric, 1.1 mm. long by half as thick, slightly asymmetrical, surmounted by a brown ring, slightly retuse at the truncate summit; staminate flowers entirely glabrous: sepals linear, 3.3 mm. long, scarious, acute; petals connate to the middle, 3.7 mm. long, the lobes lanceolate, acute; pistil rudimentary.

In swampy ground at the Grand Savanna, Esmeralda, *305*. The species is a member of the section *Thysanocephalus* Koern., as shown by its campanulate heads and imbricate bracts. Among the species of this section, its nearest allies appear to be *S. centauroides* (Bong.) Ruhl. and *S. squarrosus* Ruhl., both of Minas Geraes and both lacking the prominently reflexed bracts of our species.

SYNGONANTHUS SIMPLEX (Miq.) Ruhl. East Swamp at Esmeralda, *248;* a widely distributed species of northern South America.

SYNGONANTHUS (?) sp. An unidentifiable plant with very immature flowers, in swampy ground, Grand Savanna, Esmeralda, *300*.

Species of Mount Duida

PAEPALANTHUS CAPILLACEUS Klotzsch, var. **proliferus** Gleason, var. nov. Capitulis apice in folia rudimentaria filiformia basi dilatata proliferentibus.

Essentially like the species, except the heads subglobose and the outer bracts acute; each head proliferating at its center into 6–20 rudimentary leaves surrounded by a mass of villous hairs 2 mm. long, each leaf filiform, nearly terete, 10–15 mm. long, 0.3 mm. wide, yellowish, slightly constricted 2–4 mm. above the base, its base flattened, very thin and delicate, obovate, 1.3 mm. long, 0.9 mm. wide, truncate or slightly retuse.

On rocks under water in stream-bed, Central Camp, 4800 ft., *552*.

Paepalanthus convexus Gleason, sp. nov. Caule elongato simplice dense folioso; foliis confertis demum reflexis basi villosis linearibus subrigidis, juventute sparse villosis mox glabrescentibus; pedunculis pluribus pluristriatis tortis hirtellis; capitulis mediocribus cinereis, bracteis arcte imbricatis ovatis vel rotundatis apiculatis dense pubescentibus; bracteis stipantibus oblongis acutis nigrescentibus; flores masculi: sepalis obovato-oblongis obtusis apice villosis; corollae infundibuliformis lobis ovatis; antheris vix exsertis dithecis; flores feminei: sepalis latioribus obovatis obtusis apice dense villosis; petalis liberis oblongis dense villosis; stigmatibus brevibus bifidis appendicibus linearo-clavatis alternantibus.

Stems elongate, as much as 40 cm. long, stout, 4 mm. in diameter, densely leafy above and villous when young, denuded in age but permanently scaly with the persistent leaf-bases, unbranched; leaves crowded above, soon becoming reflexed, firm, ensiform-linear, 2–3 cm. long, 2 mm. wide, gradually tapering to an apparently acute but actually obtuse tip, sparsely villous when young, especially along the margin, soon becoming glabrous, about 9-ribbed; peduncles terminal, 2–7, 10–15 cm. long, slightly twisted, 3-sulcate, each of

the costae about 3-ribbed, glabrous in the furrows, hirtellous on the costae; vaginas equaling the upper leaves, acuminate, the orifice oblique and densely ciliate, the tube glabrous or hirtellous; heads cinereous, hemispheric, 7–8 mm. in diameter; involucral bracts spreading horizontally, imbricate, dark-brown, densely pubescent, prominently apiculate above the rounded summit, the outer broadly ovate, the inner rotund and as much as 2.5 mm. long; receptacle conic, 2 mm. high; subtending bracts oblong, 2 mm. long, 0.6 mm. wide, sharply acute or subacuminate, nigrescent, densely villous toward the tip; staminate flowers: sepals obovate-oblong, 1.6 mm. long, 0.7 mm. wide, obtuse, nigrescent, densely hirsute distally; corolla funnel-form, 1.8 mm. long, the ovate lobes equaling the tube; anthers 3, barely exserted, broadly ellipsoid, dithecous; gynoecium reduced to 3 short stout subterete rudiments; pistillate flowers: sepals obovate, 2 mm. long, 1.1 mm. wide, rounded above, nigrescent, densely hirsute distally; petals free, oblong, broadest above the middle, 2 mm. long, 0.6 mm. wide, subacute, densely hirsute within, the basal hairs 2.6 mm. long, the upper gradually reduced and all ending at about the same height; ovary stoutly ellipsoid, 0.7 mm. long; style stout, 0.8 mm. long; stigmas 3, erect, 0.9 mm. long, bifid to the middle, alternating with 3 linear-clavate appendages which are 0.9 mm. long.

First ridge, summit of Peak 7, 7100 ft., *658* (type); crest of Ridge 25, 6300 ft., with erect-ascending stems two feet long, *470*. It is a member of the subgenus *Paepalocephalus* Ruhl., section *Eriocaulopsis* Ruhl., although this section is described with a flat receptacle. Its exact position in this large section is questionable, because of its receptacle, but it apparently should be referred to the subsection *Polyactis* Ruhl.

Paepalanthus duidae Gleason, sp. nov. Caule abbreviato dense folioso; foliis anguste linearibus rigidis crassis glabris obtusis; vaginis folia aequantibus; pedunculis 6-costatis glabris; capitulis magnis, bracteis externis oblongo-ellipticis nigrescentibus obtusis; pedicellis brevibus bracteis lineari-oblongis flores aequantibus instructis; flores feminei: sepalis obovato-oblongis; petalis anguste obovato-oblongis liberis; stylo breve; stigmatibus elongatis bifidis appendicibus capitatis alternantibus; flores masculi: sepalis obovatis; petalis ad medium connatis apice inflexis; gynoecio rudimentario.

Stem abbreviated or in age somewhat elongate, densely tomentose; leaves densely tufted, very numerous, thick and rigid, somewhat recurved, narrowly linear, strongly ribbed, sharply acute, strictly glabrous, 4–6 cm. long, 1 mm. wide; peduncles 1–3, 20–25 cm. tall, 6-costate, straight or somewhat twisted, glabrous, their sheaths acute, divergent above, about equaling the leaves; heads about hemispheric, 13–18 mm. in diameter, densely woolly; outer bracts black, oblong-elliptic, 5–6 mm. long, 1.7 mm. wide, obtuse, white-hirsute distally, becoming nearly glabrous in age; inner bracts black above the middle, with a conspicuous yellow midrib, narrowly linear-oblong, curved around the flowers; 5.0 mm. long, 1.0 mm. wide, abruptly and sharply acuminate, densely

villous on the back distally; pistillate flowers: pedicels slender, glabrous, 1.7 mm. long; sepals scarious, obovate-oblong, 3.2 mm. long, 1.2 mm. wide, obtuse; petals narrowly obovate-oblong, free, 3.2 mm. long, 0.8 mm. wide, obtuse; ovary thick-ellipsoid, 3-angled, 1.0 mm. long; style stout, straight, 0.7 mm. long; stigmas 3, very slender and incurved, nearly 2 mm. long, bifid to the middle, alternating with 3 capitate appendages 0.7 mm. long; staminate flowers: lateral sepals narrowly obovate, slightly inequilateral and falcate, 2.6 mm. long, 0.9 mm. wide, obtuse, black, sparsely long-hirsute distally; dorsal sepal similar but equilateral; petals connate to the middle, 4 mm. long, the tip strongly incurved to form an obconic corolla 2.4 mm. long; gynoecium reduced to 3 clavate-spatulate rudiments.

Slopes of Ridge 25, 5500–6000 ft., *456* (type); forming tussocks at Caño Sapo, 6300 ft., *691;* summit of Peak 7, 7100 ft., *625*. The species is obviously related to *Paepalanthus roraimae* Oliver and resembles it in general habit. The Roraima plant is distinguished by its acute bracts, hirsute peduncles, vaginas much exceeding the leaves, and blunt leaves only 2–3 cm. long.

Paepalanthus robustus Gleason, sp. nov. Caule elongato dense folioso erecto; foliis patulis rigidis ensiformi-linearibus acutis juventute longe ciliatis, praesertim ad basin arcte amplectentem; vaginis folia aequantibus hirtellis apice obliquis longe ciliatis acuminatis; pedunculis solitariis leviter tortis hirtellis; capitulis magnis cinereis; bracteis involucrantibus rigidis brunneis late triangulari-ovatis acutis, basi adpressis glabris, apice subpatulis pubescentibus; bracteis stipantibus oblongo-spathulatis nigrescentibus summo villosis; flores staminei: sepalis obovato-oblongis nigrescentibus apice dense villosis; corollae tubulosae lobis anguste ovatis acuminatis; flores feminei: sepalis anguste obovato-oblongis obtusis apice villosis; petalis liberis anguste oblongis obtusis tota longitudine dense villosis; stigmatibus quam appendicibus clavatis multo longioribus.

Stems stout, erect, at least 15–20 cm. tall, completely covered by the leaves; leaves thick and rigid, yellowish green, erect or spreading, ensiform-linear, 40–55 mm. long, 3–5 mm. wide, acute, glabrous on the sides, sparsely ciliate when young, entire at maturity, their bases closely appressed, somewhat dilated, and densely long-ciliate; vaginas equaling the leaves, hirtellous, acuminate, the orifice oblique, acuminate, densely villous-ciliate; peduncles stout, about 30 cm. long, hirtellous, lightly twisted, irregularly costate; heads hemispheric, 16 mm. in diameter, cinereous; outer bracts rigid, brown, imbricate in several series, broadly triangular-ovate, acute, as much as 6 mm. long, closely appressed and glabrous at base, erect or slightly spreading and pubescent above; receptacle flat; subtending bracts narrowly oblong-spatulate, 3.3 mm. long, 0.7 mm. wide above, acute, scarious below, nigrescent above, densely villous on the distal third; staminate flowers: sepals obovate-oblong, 2.2 mm. long, 0.7 mm. wide, obtuse, nigrescent above, densely villous on the

back distally, the two lateral ones slightly falcate; corolla tubular, the tube 2 mm. long, the lobes narrowly ovate, 0.8 mm. long, acuminate, not inflexed; stamens not seen; pistillate flowers: sepals narrowly obovate, 2.9 mm. long, 0.9 mm. wide, rounded at the tip, sparsely hairy below, densely villous on the distal fourth; stigmas 3, much exceeding the linear-clavate alternating appendages which are 0.6 mm. long.

Summit of Peak 7, 7100 ft., *622*. It is obviously closely related to *P. convexus* Gleason, but is much larger in all its dimensions; it is similarly closely related to *P. subcaulescens* Brown, which has broader leaves and much smaller heads.

SYNGONANTHUS GRACILIS (Koern.) Ruhl. Gorge of Caño Negro, Savanna Hills, 4000 ft., *813;* a native of northern South America.

SYNGONANTHUS TRICOSTATUS Gleason. Gorge of Caño Negro, Savanna Hills, 4000 ft., *809;* also known from Mount Roraima, its type locality.

Leiothrix turbinata Gleason, sp. nov. Caule paullum elongato dense folioso; foliis mollibus suberectis confertis ensiformi-linearibus acutis villosis; vaginis foliis multo brevioribus hirsutis oblique fissis; pedunculis 4-costatis villosis; capitulis parvis turbinato-campanulatis; bracteis involucrantibus imbricatis adpressis late ovatis acutis pubescentibus; bracteis stipantibus lineari-oblanceolatis acutis pubescentibus; flores staminei: sepalis oblongo-ellipticis acutis apice breviter pubescentibus; petalis in tubum obconicum summo 3-lobatum connatis glabris; antheris exsertis 2-thecis; floribus femineis nondum evolutis.

Stems somewhat elongate, 8–10 cm. long, densely leafy; leaves soft, ensiform-linear, 6–8 cm. long, 5 mm. wide, acute, persistently villous; vaginas much shorter than the leaves, hirsute, the summit oblique, acuminate; peduncles 3–6, 18–25 cm. high, shallowly 4-sulcate, barely twisted, villous; heads blackish, turbinate-campanulate, 4 mm. high, 6 mm. in diameter; outer bracts appressed, dark brown, regularly imbricate in several series, the exposed tips broadly triangular-ovate, acute, thinly pubescent; receptacle concave, villous; subtending bracts linear-oblanceolate, 2.7 mm. long, 0.5 mm. wide, curved inward at the abruptly acuminate tip, densely short-pubescent toward the tip and somewhat so below; staminate flowers; sepals oblong-elliptic, 2.3 mm. long, 0.7 mm. wide, acute, scarious, glabrous below, densely short-pubescent on the distal fourth; petals connate into a narrowly obconic tube 1.9 mm. long, 3-lobed at the summit; filaments well exserted; anthers dithecous; pistillate flowers immature.

Moist slopes of Savanna Hills, 4400 ft., *775* (type); between Ridge 16 and Caño Sapo, 6300 ft., *692*. The latter has larger leaves, as much as 8 mm. wide. It is apparently related to *L. nubigena* (Kunth) Ruhl., of Minas Geraes, which has much smaller leaves, glabrous peduncles, and acuminate outer bracts.

RAPATEACEAE

Lowland species

CEPHALOSTEMON AFFINIS Koernicke. Open savanna swamp at Esmeralda, no. 176. It is known only from this locality, where it was originally collected by Spruce.

Monotrema xyridoides Gleason, sp. nov. Foliis distichis paucis; vaginis patulis anguste triangularibus gradatim angustatis; laminis linearibus obtusis; scapis gracilibus sulcatis; capitulo unico ovoideo obtuso; bracteis externis 2 brevibus ovatis obtusis; bracteis subtendentibus numerosis ovatis obtusis flores subamplectentibus et contegentibus; bracteis floralibus 10, ovato-lanceolatis subaequalibus; sepalis triangulari-lanceolatis; capsula ovoidea truncata; seminibus rhomboideis complanatis rostratis.

Leaf-sheaths narrowly triangular, castaneous, 8 cm. long, 9 mm. wide at base, gradually tapering to a rounded, closely appressed or adnate tip; blades linear, about 25 cm. long, 6–7 mm. wide, bluntly rounded and subcartilaginous at tip, 5-striate on one side of the midvein, 6-striate on the other; peduncular sheath about 6 cm. long; scapes erect, 45–55 cm. tall, 1 mm. in diameter, 5–6-sulcate, gradually enlarged near the summit to 2.5 mm. in diameter; heads solitary, broadly ovoid, 15 mm. long, 10 mm. in diameter, blunt or rounded above, castaneous; outer bracts 2, broadly ovate, coriaceous, obtuse, 8 mm. long; flowers about 25, each subtended, partly enclosed, and largely concealed by a subtending bract which is broadly ovate, about 7 mm. long, coriaceous, obtuse or rounded, often split at end at maturity; flowers ovoid, about 6 mm. long; floral bracts about 10, ovate-lanceolate, obtuse, 4.4–5.5 mm. long; sepals triangular-lanceolate, acute, 5.1 mm. long; capsule horny in consistency, pale yellow, ovoid, truncate at summit, 3.5 mm. long, 3-celled and 3-seeded, each valve swollen at base over the seed and prismatic-trigonous above; seeds brown, rhomboid, flattened, 1 mm. long and nearly as wide, with an erect beak 0.5 mm. long (Pl. 25).

East Swamp at Esmeralda, *245*. The remarkable feature of the species is the presence of a subtending bract at the base of each flower, nearly as large as the two involucral bracts at the base of the head, and practically concealing the flowers. The head accordingly greatly resembles that of a *Xyris*, whence the specific name. Apart from this structure, there is no doubt of its affinity with *Monotrema*. It is apparently nearest to *M. aemulans* Koern., which also has short outer bracts, obtuse inner bracts, slender sulcate peduncles, and obtuse leaves.

Species of Mount Duida[1]

Amphiphyllum Gleason, gen nov.

Involucri folia 3 (an semper?) erecta, primo complicato lato secundum complicatum occludente, tertio parvo plano. Flores circiter 10 capitati sessiles.

Bracteae circiter 20 erectae acuminatae. Sepala bracteiformia. Antherae lineari-subulatae apice acuminatae poro obliquo terminali-introrso dehiscentes. Ovarium 3-loculare ovulis in quoque loculo 2 superpositis.

Scapose herbs, the leaves with short sheath and linear multicostate blades. Involucre of 3 (possibly in other heads only 2) erect bracts, the outer covering the whole head, strongly folded, carinate on the back, apparently splitting down the back at anthesis, the second narrower and folded, the third much smaller and flat. Flowers about 10, sessile and capitate. Bracts on each flower about 20, all oblong-lanceolate and sharply acuminate, the outer two-thirds as long as the longest, which slightly exceed the innermost. Sepals with blades resembling the inner bracts. Petals sharply acute or short-acuminate. Stamens 6, the anthers linear-subulate, acuminate, opening by a single oblique terminal-introrse pore. Ovary conic, 3-celled, the ovules two in each cell, superposed.

The name refers to the bracts which closely surround the head.

Amphiphyllum rigidum Gleason, sp. nov. Foliorum vaginis anguste triangulari-ovatis apice acutis; laminis elongatis rigidis linearibus acutis pluricostatis; scapis erectis glabris sicco angulatis superne complanatis paullum dilatatis; involucri foliis ovatis acuminatis; bracteis oblongo-lanceolatis.

Leaf-sheaths carinate, strongly folded, triangular-ovate, each half about 13 mm. wide and at least 6 cm. long, tapering regularly to the acute tip; blades thick and rigid, narrowly linear, sharply acute, about 9-ribbed, 6–9 mm. wide, about 9 dm. long; scapes at least 6 dm. high, strongly angled below when dry, flattened and expanded toward the top and 8 mm. wide at the apex; outer leaf of the involucre as much as 40 mm. long by 32 mm. wide, broadly

[1] Having already observed the single common species of this family at Mount Roraima, my interest was at once awakened on Mount Duida by the remarkable differentiation of these plants, to which we gave the name "strap-leaf." The species first observed on Ridge 25, *Stegolepis guianensis*, appeared to be identical with that of Roraima. Nearby grew the very much larger *Stegolepis pauciflora*, with stouter leaf-bases and broader blades. This species, which was perhaps the most abundant and widespread of them all, grew upon most of the crests and upper slopes of the plateau, seeming to prefer moist or boggy spots. *Stegolepis pungens*, first noted at Brocchinia Hills and Savanna Hills, and the narrow-leaved *Stegolepis linearis* have a peculiar property. While the glossy leaves of practically all members of the family reflect light strongly, in these two species the leaves reflect the blue of the sky like water does. My Indians, when cutting trail to High Point, reported on Ridge 16 a "grass with blue leaves." The next evening they brought in a specimen of this plant (*S. linearis*). Since the daylight had almost gone, the leaves appeared no less green than any others. It was not until later that I was able to observe the phenomenon of reflection for myself. This narrow-leaved plant is rather scarce, being found only on Ridge 16 and Savanna Hills. Another interesting species is *Saxo-Fridericia regalis*, with leaves 5 meters in length, which I found only in Camp Woods at Savanna Hills. The plant is entirely dependent upon adjoining vegetation for the support of its unwieldy leaves. It was not flowering when discovered.—G.H.H.T.

ovate, sharply acuminate, carinate on the back, veinless, its base covering nearly the whole head and its outer edges adjacent below; second leaf similar, ovate-lanceolate, 26 mm. long, 13 mm. wide; third leaf flat, oblong-lanceolate, 21 mm. long, 7 mm. wide; flowers about 10, sessile, crowded on a flat receptacle, 21 mm. long before anthesis; bracts about 20, all erect, appressed only at base, oblong-lanceolate, sharply acuminate, the outermost 13 mm., the largest 18 mm., the innermost 15 mm. long; flowers in the specimen not yet expanded, the claws of the sepals and petals and the filaments therefore not yet elongated (Pl. 25).

In a swamp on the slopes of the Savanna Hills, 4400 ft., *780*. Unfortunately our specimen does not show fully developed flowers so that measurements of the flower-parts have not been given. The characters observed are nevertheless sufficient to separate it from all other genera of the family, of which only eight others are known. Of these, only *Saxo-Fridericia*, *Schoenocephalium*, and *Stegolepis* have two or more ovules in each cell of the ovary. In the first of these three the two bracts of the involucre are connate into a sac surrounding the flowers and the anthers open by a longitudinal cleft; in the second the involucre is smaller, the bracts are obtuse, and the anthers open by two pores. In the third there is no involucre and the outermost bracts are greatly reduced in size. *Stegolepis* stands nearest to our genus, resembling it in vegetative habit and anthers.

SAXO-FRIDERICIA REGALIS Schomb. Savanna Hills, 4400 ft., *795;* hitherto known only from high altitudes on Mount Roraima and from lower elevations in the sandstone region of British Guiana. Its leaves, which are only 30–35 mm. wide, attain a length of four meters, as evidenced by the dry specimens, or of nearly five meters, according to the field notes of Mr. Tate.

The genus *Stegolepis* has hitherto included three species, all endemic to the sandstone region of British Guiana, where the original species was first collected by Schomburgk at high altitudes on Mount Roraima. The other two are limited, so far as known, to the Kaieteur Savanna. Three others are now to be added from Mount Duida. The distinguishing characters of the six are shown in the following brief key:

Flowers very numerous in a dense head, radiating in all directions from the summit of the scape.
  Leaf-sheaths obtuse, rounded or auriculate at the summit.
    Flowers, excluding the petals, 12–15 mm. long; scapes conspicuously flattened at the summit *S. guianensis* Kl.
    Flowers, excluding the petals, 7–8 mm. long; scapes very slender, scarcely flattened *S. ferruginea* Baker.
  Leaf-sheaths gradually narrowed to the summit *S. angustata* Gl.

Flowers 1–10, the scape strongly flattened above, rounded at the summit, and bearing a solitary flower, or 2–10 flowers in a single row, radiating fanwise.

Leaf-sheaths tapering gradually to the blade *S. linearis* Gl.

Leaf-sheaths broad, abruptly rounded to the summit.

Flowers 1 or 2, as much as 17 mm. long excluding the corolla; bracts obtuse or subacute; leaf-sheaths opaque, auricled at the summit *S. pauciflora* Gl.

Flowers 6–10, as much as 32 mm. long excluding the corolla; bracts sharply acuminate; leaf-sheaths shining, rounded at the summit *S. pungens* Gl.

STEGOLEPIS GUIANENSIS Klotzsch. Crest of Ridge 25, alt. 6300 feet, with scape five feet high, *399*. The specimen is referred here with some doubt, since the characteristic leaf-sheaths are not present. It has been known hitherto only from the summit and upper slopes of Mount Roraima.

Stegolepis linearis Gleason, sp. nov. Foliis distichis dense confertis; vaginis adpressis anguste triangularibus ad apicem angustatis; laminis linearibus elongatis crassis rigidis; scapis inferne gracilibus superne dilatis complanatis et ad laterem unum obscure carinatis; floribus 1–3 involucro nullo sessilibus; bracteis brunneis glabris adpressis induratis, extimis triangularibus, mediis obovato-oblongis, intimis oblongis, omnibus acutis; antheris linearibus apice poro unico introrso dehiscentibus; ovarii loculis 3-spermis.

Leaves distichous, the basal sheaths crowded in a dense cylindric cluster 3 cm. in diameter, 10–12 cm. long, 5 cm. wide at base, somewhat carinate, tapering regularly to the acute summit; blades exceedingly rigid and more or less twisted, narrowly linear, 6–8 mm. wide, 50–70 cm. long, 9-ribbed, narrowed above to an obtuse apex; scapes 40–80 cm. high, erect, slender and subterete below, gradually expanded and flattened near the summit and at the top 3–10 mm. wide, depending on the number of flowers, the summit obscurely carinate on one side only; involucre none; flowers sessile, stoutly fusiform, 10–12 mm. long, 7 mm. in diameter; bracts about 20–25, arranged in 6 rows, the outermost triangular, 3 mm. long, the next broadly ovate, and successive bracts gradually elongating to as much as 9 mm. and obovate-oblong to oblong in shape, all closely appressed and acute; claw of the petals 7 mm. long, the blade broadly flabellate, about 20 mm. long and wide; filaments flat and scarious below, where they are adnate to the corolla, slender above, 11 mm. long at anthesis; anthers linear, acuminate, opening by a single subterminal introrse pore; ovary conic, 3-celled, with 3 ovules superposed in each cell; style slender, 17 mm. long; stigma punctiform (Pl. 25).

On Peak 15, 6700 ft., *574* (type); in a swamp on the slopes of the Savanna Hills, 4400 ft., *734*, *781*. The description of the flower is from *734*, which alone displayed expanded flowers.

Stegolepis pauciflora Gleason, sp. nov. Foliorum vaginis complicatis late ovatis apice auriculatis; laminis late linearibus crebre venosulis; scapis elongatis glabris summo vix expansis, involucro nullo nisi bracteis 2 infimis quam vicinis parce majoribus; floribus 1 vel 2, sessilibus mediocribus; bracteis in-

ferne triangularibus usque intimis oblongo-lanceolatis, omnibus viridibus aut stramineis adpressis obtusis vel subacutis; sepalis basi longe unguiculatis laminis oblongo-lanceolatis exsertis; petalis unguiculatis, laminis rotundis patulis; filamentis ad basin corollae adnatis scariosis; antheris subulatis poro terminale introrso dehiscentibus.

Leaf-sheaths distichous and closely imbricated, 15 cm. long, carinate on the back, each half ovate-oblong, 6 cm. wide, somewhat narrowed above and ending in a broad rounded auricle prolonged 20–25 mm. above the base of the blade, the surface opaque and essentially veinless, the margin membranous or subscarious; blade about 70 cm. long, 25 mm. wide at base, increasing to 50 mm. 15 cm. above the base, thence very gradually tapering to the obtuse tip, finely many-nerved; scapes about equaling the leaves in height, slender and somewhat bicarinate below, slightly expanded and flattened above, 5 mm. wide at the summit when 2-flowered; involucre none, but in 2-flowered heads the two lowest bracts are slightly larger than those immediately above them; flowers 1 or 2, sessile; bracts gradually changing from broadly triangular and 3 mm. long at the base to oblong-lanceolate and 13 mm. long above, all obtuse or subacute; sepals exserted at anthesis, the oblong claw 8.5 mm. long, the oblong-lanceolate, spreading or reflexed blade 17 mm. long; petals yellow, spreading, the claw 10 mm. long, the rotund (?) blade 20 mm. long and wide; filaments thin and flat, 12 mm. long, adnate to the corolla at base; anthers linear-subulate, 10 mm. long, opening by a single terminal introrse pore (Pl. 25).

Summit of Ridge 22A, *1008*, bearing 2-flowered heads (type); crest of Ridge 25, 6300 ft., *527*, the specimen consisting of the tops of 1-flowered scapes only.

Stegolepis pungens Gleason, sp. nov. Foliorum vaginis complicatis late ovatis nitentibus superne rotundatis; laminis crassis rigidis late linearibus venosulis obtusis; scapis elongatis complanatis pluricostatis apice dilatatis rotundatis; involucro nullo nisi duabus cicatricibus linearibus; floribus 6–10 sessilibus usque 32 mm. longis corolla delapsa; bracteis extimis ovato-triangularibus superioribus majoribus ovato-oblongis acutis intimis oblongo-lanceolatis acuminatis, omnibus ferrugineis; sepalis longe unguiculatis laminis exsertis oblongo-lanceolatis acuminatis; petalis unguiculatis laminis basi cuneatis; filamentis basi alte connatis in tubum ovarium cingentem partibus liberis scariosis; ovario stipitato conico-ovoideo acuto; stylo terete basi tumido.

Leaf-sheaths coriaceous, smooth and shining, each half broadly ovate, 9 cm. wide with membranous margins, veinless, rounded at the summit; leaf-blades thick, rigid, broadly linear, 20–25 mm. wide at the base, with maximum width of 65 mm. 15 cm. above the base, nearly 5 dm. long, obtuse, with numerous fine nerves; scapes as much as a meter high, flattened, many-costate, dilated at the top and ending in a rounded, almost semicircular tip; involucre none, but the summit of the scape is marked by two elongate, narrow, over-

lapping membranes 1 mm. wide; flowers 6–10, sessile, as much as 32 mm. long without the corolla; bracts brown, indurated, appressed at base, the tips slightly spreading, the lowest triangular, 5 mm. long, the upper changing to ovate-oblong and finally oblong-lanceolate, the uppermost 22 mm. long; claw of the sepals 12 mm. long, 3 mm. wide, the oblong-lanceolate acuminate blade 13–14 mm. long; claw of the petals 10 mm. long, the base of the blade (now badly broken) broadly cuneate; filaments 10 mm. long, their broadened bases connate for 7–8 mm. into a tube surrounding the ovary, the short free portion flat and scarious; anthers fallen; ovary on a stout obconic dark brown stipe 1.5 mm. long, itself stoutly ovoid, acute, 4 mm. long, marked with three longitudinal stripes, 3-celled, each cell with 6 or 8 ovules; style slender, 15 mm. long, minutely swollen at base; stigma punctiform; capsule loculicida (Pl. 21, 25).

Savanna Hills, 4400 ft., *1043* (type, with corollas still persisting); Brocchinia Hills, 4500 ft., *591* (past bloom). On both specimens the full length of the sheath is not determinable; it is at least 14 cm. long. The four heads bear respectively 6, 7, 8, and 10 flowers.

BROMELIACEAE[1]

Lowland species

Brocchinia prismatica L. B. Smith, sp. nov. Metralis: foliis ad 40 cm. longis, laminis a vaginis vix distinctis, anguste triangularibus, involutis, 2–3 cm. latis, lepidibus minutissimis obtectis, conspicue lacunosis; scapo erecto, vaginis foliaceis internodos superantibus obtecto; inflorescentia laxe bipinnata; bracteis primariis parvis, lanceolato-acuminatis; racemis gracilibus, ca. 20 cm. longis, laxe multifloris; bracteis florigeris minutis, pedicellos subaequantibus; floribus erectis, in pedicellos sensim transeuntibus; sepalis 4.5 mm. longis; staminibus liberis; capsula circuitu elliptica, 1 cm. longa, bene triangulatim prismatica; seminibus utroque polo ala angusta auctis.

Almost a meter high; leaves rosulate, 40 cm. long, scarcely any distinction between the blade and the sheath, blade narrowly triangular, involute, 2–3 cm. wide, minutely appressed-lepidote, appearing glabrous to the naked eye, lower surface definitely lacunose: scape erect, slender, terete, glabrous, its bracts leaf-like and exceeding the internodes; inflorescence laxly bipinnate; primary bracts small, lance-acuminate, scarcely attaining the lowest flower of the raceme; racemes slender, about 20 cm. long, laxly many-flowered; floral bracts minute, about equaling the flower-pedicels; flowers erect, gradually tapering below into the pedicels; sepals 4.5 mm. long; stamens free, shorter than the petals; capsule elliptical in outline, almost wholly inferior, 1 cm. long, strongly three-angled; seeds flat with a narrow wing at either end (Fig. 3).

Swampy ground, Grand Savanna, section 1, Esmeralda, *281*. This species is quickly distinguished from the others of the genus by its broad

[1] By L. B. Smith.

strongly three-angled capsule. With *B. reducta* it shares the peculiar character of lacunose leaves.

PITCAIRNIA NUDA Bak. Rocky top of Esmeralda Ridge, Esmeralda, *213;* also in British and Dutch Guiana.

TILLANDSIA ALOIFOLIA Hook. On rocks and trees, summit of Esmeralda Ridge, *228;* ranging from southern Florida and the West Indies to Panama and the coasts of Colombia, Venezuela, and the Guianas, usually near sea-level.

Species of Mount Duida

BROCCHINIA REDUCTA Bak. Moist slopes of Savanna Hills, 4400 ft., *846.*[1]

The following which consist of leaves only undoubtedly belong here because of the rounded-apiculate summit and lacunose surface; summit of Peak 7, 7100 ft., *618;* Central Camp, 4800 ft., *576a;* ridge northwest of Vegas Brook, 4400 ft., *569.*

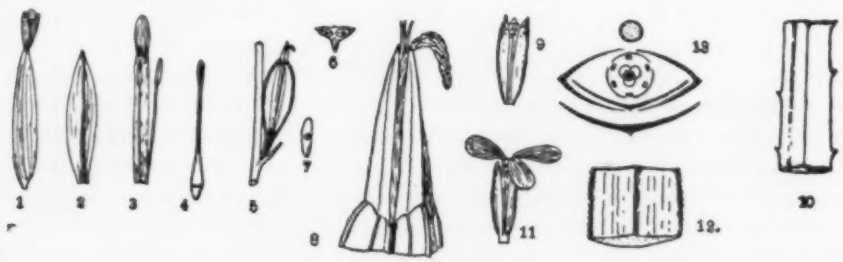

Fig. 3.

1—4. *Tillandsia duidae.* 1. Flower. 2. Sepal. 3. Petal and stamens. 4. Pistil. All natural size.

5—8. *Brocchinia prismatica.* 5. Flower. 6. Cross-section of ovary. 7. Seed. 8. Summit of flower, ×5; all others natural size.

9, 10. *Navia duidae.* 9. Abaxial view of sepals, natural size. 10. Section of leaf, ×5.

11, 12. *Navia brachyphylla.* 11. Abaxial view of flower, natural size. 12. Section of leaf, ×5.

13. Floral diagram of *Navia duidae* and *N. brachyphylla.*

Navia duidae L. B. Smith, sp. nov. Bene caulescens, ad 9 cm. alta; foliis angustissime linearibus, 9 cm. longis, 3 mm. latis, remote minuteque spinulosis, subtus cinereo-lepidotis; inflorescentia simplici, capituliformi, in foliorum

[1] *Brocchinia reducta* frequents boggy spots on slopes where the soil as a rule is thin. It was common at Brocchinia hills, in wet places on Savana Hills, and locally nearer the precipices. Another species of *Brocchinia*, besides occupying the Bromelia zone on the crest slopes of Ridge 25, formed much of the lush moist undergrowth in the Valley Headwoods, at Central Camp, and in the moist wooded parts of Savana Hills. It may thought of as occupying the bottoms of most of the valleys and depressions of the plateau. Its flowering stems are considerably higher than a man.—G. H. H. T.

centro nidulante; sepalis liberis, ovatis, acutis, carinatis, bene complanatis, membranaceis, 12 mm. longis; petalis albis (ex cl. G. H. H. Tate), quam sepala multo longioribus, laminis latis; staminibus styloque exsertis (?), ovario anguste ovoideo, supero.

Strongly caulescent, 9 cm. high; leaves crowded along the stem and stiffly spreading, 9 cm. long, sheaths submembranous, almost orbicular, blades narrowly linear, acuminate, pungent, 3 mm. wide, finely and remotely serrate, the teeth less than 0.5 mm. long and fully 2 mm. apart, glabrous above, cinereous-lepidote below; inflorescence simple, capitate, sessile at the end of the stem and obscured by the top leaves; sepals free, ovate, acute, keeled, strongly compressed, membranaceous, 12 mm. long, both the posterior overlapping the anterior; petals white (acc. to G. H. H. Tate), much longer than the sepals, their blades broad and probably spreading; stamens and styles exserted (difficult to be certain as the flowers are soft and preserve badly), ovary slenderly ovoid, superior (Fig. 3).

Crest or slope of Ridge 25, 5500–6300 ft., *404*.

The following specimen, though sterile and with somewhat narrower leaves, apparently belongs here; Agüita, slopes of Mt. Duida, 3100 ft., *936*.

Navia brachyphylla L. B. Smith, sp. nov. Caulibus 3–6 dm. longis, quaquaverse denseque foliosis; foliis rigidis; vaginis parvis, pallide brunneis, subscariosis, dissite minuteque lepidotis; laminis anguste triangularibus, 5 cm. longis, 4.5 mm. latis, viridibus, margine atro-brunneis, dense minuteque denticulatis, supra glabris, subtus minute peradpresseque lepidotis mox glabris; inflorescentia dense capituliforme, in foliorum centro nidulante, 1 cm. diametro metienti; bracteis florigeris anguste lanceolatis, acutis, 12 mm. longis, membranaceis, pallide brunneis, apice minute brunneo-lepidotis; floribus breviter crasseque pedicellatis; sepalis anguste lanceolatis, acutis, bracteis valde similibus, 10–11 mm. longis, apice minute dissiteque brunneo-lepidotis; petalis flavis, ad 18 mm. longis, basin versus in tubum connatis, lamina obovata.

Stems 3–6 dm. long; leaves densely many-ranked, rigid; their sheaths small, pale brown, sparsely fine-lepidote, subscarious; blades narrowly triangular, 5 cm. long, 4.5 mm. wide, green with a dark brown margin, densely and minutely denticulate, glabrous above, minutely appressed-lepidote below, soon becoming glabrous; inflorescence densely capituliform, immersed in the center of the terminal leaf-rosette, 1 cm. in diameter; floral bracts narrowly lanceolate, acute, 12 mm. long, membranaceous, pale brown, minutely brown-lepidote at apex; flowers with short stout pedicels; sepals narrowly lanceolate, acute, almost exactly like the floral bracts in appearance, 10–11 mm. long, sparsely and finely brown-lepidote at apex, the two lateral sepals strongly conduplicate and enclosing the nearly flat abaxial sepal; petals yellow, up to 18 mm. long, connate into a tube below, blade obovate; style and stamens included (Fig. 3).

Ridge northwest of Vegas Brook, 4400 ft., *571.*

A brief summary of the genus Navia will indicate the position of the two new species here proposed:

Inflorescence paniculate, with a distinct scape — *N. caulescens.*
Inflorescence capituliform, sunk in the center of the terminal leaf-rosette.
Leaves 12–15 mm. broad; acaulescent: sepals 19 mm. long — *N. angustifolia.*
Leaves not over 6 mm. broad; caulescent or acaulescent; sepals not over 12 mm. long.
Leaf-blades entire except for a few rudimentary teeth near the base *N. Gleasonii.*
Leaf-blades evenly spinulose-denticulate.
Leaf-blades remotely spinulose — *N. duidae.*
Leaf-blades densely spinulose.
Plant aculescent or nearly so; sepals glabrous — *N. acaulis.*
Plant long-caulescent; sepals lepidote — *N. brachyphylla.*

PITCAIRNIA NUDA Bak. The following which consist of leaves only probably belong here: crest of the Savanna Hills, 4400 ft., *857;* crest of Ridge 23½, 6000 ft., *575c.*

Tillandsia (§ ALLARDTIA) **duidae** L. B. Smith, sp. nov. Certe metralis vel ultra: foliis lingulatis, apice breviter acutis, ad 40 cm. longis, super vaginam anguste ellipticam 4 cm. latis, lepidibus minutissimis obtectis; scapo ignoto; inflorescentia laxe tripinnata, 30 cm. longa; axi leviter flexuoso, angulato, glabro; bracteis primariis ovato-acutis, patentibus, rubris, quam ramos axillares 1–2-spicatos multo brevioribus; spicis dense 6–12-floris, lineari-lanceolatis, ad 7 cm. longis, 15 mm. latis (statu florifero), vix complanatis; rachide glabra, angulata, leviter geniculata; bracteis glabris, subcoriaceis, carinatis, nervatis, ad 20 mm. longis, sepala superantibus; sepalis liberis, oblongo-lanceolatis, acutis, carinatis, nervatis, glabris; petalis quam sepala 5 mm. longioribus, laminis angustis; staminis inclusis, stylum subaequantibus.

At least a meter high: leaves ligulate, abruptly acute, 40 cm. long, 4 cm. wide above the narrowly elliptic sheath, green, minutely appressed-lepidote, appearing glabrous; scape not known; inflorescence laxly tripinnate, 30 cm. long; axis slightly flexuous, angled, glabrous; primary bracts ovate-acute, spreading, subcoriaceous, red, about half as long as the axillary branches of 1–2 spikes; spikes densely 6–12-flowered, linear-lanceolate, 7 cm. long, 15 mm. wide (before the capsules spread the bracts), scarcely compressed at all; rachis glabrous, angled, slightly geniculate; floral bracts glabrous, subcoriaceous, keeled, nerved, 20 mm. long, exceeding the sepals; sepals free, oblong-lanceolate, acute, keeled, nerved, glabrous; petals 5 mm. longer than the sepals, blade narrow; stamens included, about equaling the slender style (Fig. 3; Pl. 26).

Slopes of Ridge 25, 5500–6000 ft. *437.* It is suggestive of *T. elata* Bak. in the general form of leaves and inflorescence, but the sepals are free and the spikes are scarcely if at all compressed.

TILLANDSIA FENDLERI (Bak.) Mez. Epiphytic, crest of Ridge 25, 6300 ft., *520;* formerly known from Cuba (fide Harms), Haiti, and northern

Venezuela. The Duida specimen is stunted and not altogether typical, a result possibly of the high altitude at which it grew.

TILLANDSIA MICRANTHA Bak. Laterite Valley, Savanna Hills, 4400 ft., *782;* formerly known from Trinidad and the Island of Margarita off the coast of Venezuela.

TILLANDSIA TURNERI Bak. Summit of Peak 7, 7100 ft., *1046;* known also from Mt. Roraima in British Guiana and the Andes of Colombia. No. *608* from the same locality but consisting of leaves only probably belongs to this species also.

COMMELINACEAE

Lowland species

DICHORISANDRA HEXANDRA (Aubl.) Kuntze. Left bank of the Rio Casiquiare at Quemapure, *168;* widely distributed in tropical South America.

PONTEDERIACEAE

Lowland species

PIAROPUS CRASSIPES (Mart.) Britt. Floating at edge of the river, Esmeralda, *307;* common in quiet waters throughout the American tropics.

LILIACEAE

Lowland species

SMILAX BENTHAMIANA A. DC. Rocky top of Esmeralda Ridge, *200;* hitherto known only from the original collection by Spruce along the Rio Negro.

Species of Mount Duida

SMILAX FLORIBUNDA Kunth. Hillsides and flat ground at Central Camp, 4800 ft., sterile, *541;* a vine with immature fruit on Agüita Slope, 4000 ft., *869*. The species is also distributed through the Andes at moderate altitudes from Colombia to Peru.

TOFIELDIA SCHOMBURGKIANA Oliver. On rocks in stream-bed at Central Camp, flowers green, 4800 ft., *546;* Caño Sapo, 6300 ft., *690;* summit of Peak 7, 7100 ft., *655;* previously known only from high altitudes on Mount Roraima.

VELLOZIACEAE

Species of Mount Duida

BARBACENIA ALEXANDRINAE Schomb. Dry ridge tops, Savanna Hills, 4400 ft., *801*. Schomburgk is apparently the only botanist who has hitherto observed this remarkable plant in the field. Sterile plants were found by him on the Humirida Mountains, just south of Roraima, and fertile plants

were collected later near the source of the Caroni. It probably occurs in isolated patches in suitable habitats throughout this sandstone range of mountains.[1]

DIOSCOREACEAE

Lowland species

DIOSCOREA MEGACARPA Gleason. Santa Isabel, on the Rio Negro, northern Brazil, *1053;* also known from the Guianas and the northern Amazon region.

MUSACEAE

Species of Mount Duida

HELICONIA GLAUCA Poit. Slopes of the mountain at Agüita, 3100 ft., *900*. The species is distributed from northern Brazil to the Caribbean Sea.

ZINGIBERACEAE

Lowland species

COSTUS CYLINDRICUS Jacq. In forest, Santa Isabel, northern Brazil, *79;* perhaps the commonest species of the genus, widely distributed through tropical South America and the West Indies.

RENEALMIA (?) EXALTATA L. f. Preguisa, on the Rio Negro, northern Brazil, *144*.

RENEALMIA FLORIBUNDA K. Schum. Caxoeira San Sebastian, on the Rio Casiquiare, Venezuela, *152*. The two specimens of this genus are both without leaves and can not be identified satisfactorily.

CANNACEAE

Lowland species

CANNA COCCINEA Mill. Buena Vista, on the Rio Casiquiare, Venezuela, *155*. This is the commonest species of *Canna* in northern South America and ranges from Bolivia to the West Indies.

MARANTACEAE

Lowland species

ISCHNOSIPHON LEUCOPHAEUS (Poepp. & Endl.) Koern. Mouth of the Casiquiare Canal on the Colombian side, *1003;* New Savanna at Esmeralda, *952;* known only from this general region.

[1] The only specimens seen of this oddly branching plant were growing at Savana Hills. On the crest of the ridge, plants were scattered sparsely among the bushes or in the open. Strangely a few flood-torn specimens were also noted in the rocks in the bed of the Caño Negro. The largest individuals observed were about six feet high.—G. H. H. T.

BURMANNIACEAE

Lowland species

BURMANNIA BICOLOR Mart. East Swamp at Esmeralda, *264;* distributed from Brazil to the West Indies.

Burmannia bracteosa Gleason, sp. nov. *B. capitatae* affinis: foliis basalibus nullis, caulinis anguste ovatis; caulibus gracilibus cymis dichotomis multifloris; bracteis oblongis patulis vel recurvatis; floribus confertis secundis brevissime pedicellatis; ovario et corollae tubo triangulare non alato, lobis erectis triangularibus marginibus inflexis conniventibus; filamentis brevissimis reflexis.

Stems very slender, leafless below, 15–25 cm. tall, with about four narrowly ovate appressed scales 2–3 mm. long, the upper one of which occasionally subtends a much reduced flowering branch; cyme bifurcate, its branches straight, ascending, 10–15 mm. long, bearing as many as 13 flowers; flowers sessile, crowded, strictly secund, bracteate; bracts narrowly oblong, 2 mm. long, 0.8 mm. wide, sharply acute, strongly folded down the midvein, borne on the upper side of the rachis and conspicuously spreading or recurved to the outside; ovary at anthesis 2.3 mm. long, obpyramidal, sharply 3-angled; 3-celled with axile placentae; perianth-tube triangular, not winged or expanded above, 2.7 mm. long; perianth-lobes 3, broadly ovate, 0.8 mm. long, erect, sharply acute, the margins inflexed above and connivent to form a cucullate tip; filaments very short, reflexed, with the acuminate connective 0.6 mm. long; anthers 0.6 mm. wide, of which the triangular-ovoid thecae and the transverse connective each measure 0.2 mm. (Pl. 24, fig. 2).

Growing in the East Swamp at Esmeralda, *268*, in part. It is closely related to *B. capitata* (Walt.) Mart., the two being the only species with wingless perianth and erect or connivent perianth-lobes. Our species is characterized by its longer inflorescence, its conspicuous spreading bracts, and its sessile flowers.

BURMANNIA CAPITATA (Walt.) Mart. East Swamp at Esmeralda, *268*, in part; a widely distributed species, extending from the southern United States to Brazil (Pl. 24, fig. 2).

Species of Mount Duida

Burmannia foliosa Gleason, sp. nov. Caule erecto simplice ad dimidium folioso superne bracteoso; foliis late linearibus caulem vaginantibus; bracteis adpressis; floribus in racema capituliforme dense aggregatis breviter pedicellatis; bracteis obovato-oblongis quam floribus brevioribus; hypanthio obconico triquetro, angulo infero subalato; perigonii tubo non ampliato, segmentis exterioribus late ovatis ad anthesin irregulariter bilobis quam interioribus dupla vel ultra longioribus, interioribus quadrato-obovatis truncatis margine dense pubescentibus; staminibus sessilibus, connectivo apice rotundato basi breviter prolongato truncato, thecis reniformibus; stigmatibus 3 ovoideis divaricatis.

Stems herbaceous, simple, erect, 1–3 dm. high, densely leafy on the basal third or half, bracteate above; leaves sessile, broadly linear, 3–6 cm. long, 6–8 mm. wide, strongly sheathing and appressed at the amplexicaul base, spreading above, acute and glandular-callous at the apex, 5–7-nerved; bracts appressed, lanceolate, amplexicaul, 1–2 cm. long, acuminate to the glandular tip, much shorter than the internodes; flowers numerous, closely aggregated in a dense head-like raceme 1 cm. in diameter, apparently blue; bracts very thin, sessile, obovate-oblong, 5 mm. long, 2 mm. wide, obtuse or subacute and minutely erose near the summit, obscurely 1–3-nerved; pedicels 3-angled, nearly 2 mm. long; hypanthium obpyramidal, 3-angled, the lower angle subalate, 2.5 mm. long; perianth-tube not expanded, 1.5 mm. long; sepals broadly ovate, 1.3 mm. long and wide, obtuse, the tip shallowly 2-lobed at anthesis; petals quadrate-obovate, truncate, 0.5 mm. long and wide, minutely pubescent on the margin, the central portion convex toward the inside, their margins continued laterally at the base into a membrane adnate to the sepals, forming 6 minute sacs; stamens 3, sessile; connective ellipsoid. 0.5 mm. long, rounded above, truncate below; thecae lateral, reniform; style stout, 1.5 mm. long; stigmas 3, fleshy, rounded, and spreading; ovary inferior, 3-celled; ovules very numerous, on axial placentae.

Summit of Peak 7, 7100 ft., *630* (type); at Caño Sapo, 6200 ft., *598*. This new *Burmannia*, remarkable for its leafy stems, is related to *B. Kalbreyeri* Oliver and *B. polygaloides* Schltr., which are similarly leafy. The former, from Colombia, is differentiated by its much longer leaves, loose open racems, acute sepals, and minute linear-lanceolate petals. The latter resembles ours in its inflorescence and obtuse petals, but has much smaller and narrower leaves, linear-lanceolate bracts, and acuminate sepals.

(*Continued in the June issue*)

FIG. 1. MOUNT DUIDA, FROM THE ORINOCO RIVER AT ESMERALDA

FIG. 2. SOUTHERN END OF MOUNT DUIDA. FROM LEFT TO RIGHT: PEAKS 7, 15, AND 21-22

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FIG. 1. ESMERALDA SAVANNA AND MOUNT DUIDA. MOUNT MARAHUACA IS BARELY VISIBLE IN THE RIGHT BACKGROUND

FIG. 2. EDGE OF THE CLIFFS AT PEAK 7. SUMMIT OF MOUNT DUIDA

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FIG. 1. STREAM-BED ABOVE VEGAS FALLS. SUMMIT OF MOUNT DUIDA

FIG. 2 VIEW TO THE EAST ACROSS THE SAVANNA HILLS. SUMMIT OF MOUNT DUIDA, TO MOUNT MARAHUACA IN THE DISTANCE

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FIG. 1 CANO NEGRO, NEAR CENTER OF THE PLATEAU, SUMMIT OF MOUNT DUIDA

FIG. 2. TRAIL THROUGH A MORE OPEN PART OF THE FOREST, SUMMIT OF MOUNT DUIDA

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FIG. 1. WATERFALL NEAR CENTRAL CAMP, SUMMIT OF MOUNT DUIDA

FIG 2 STEGOLEPIS PUNGENS

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HYMENOPHYLLOPSIS ASPLENIOIDES X 3/4

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PTEROZONIUM TATEI X 1/2

OF MICH

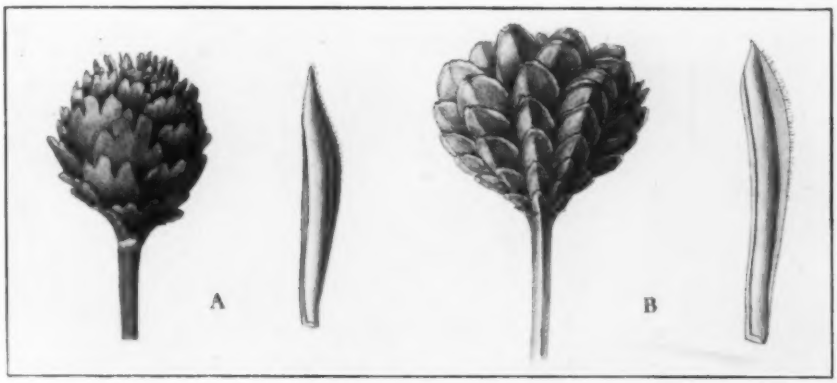

FIG. 1. A. XYRIS LUGUBRIS. SPIKE × 2. LATERAL SEPAL × 6.
B. XYRIS TATEI. SPIKE × 2. LATERAL SEPAL × 6

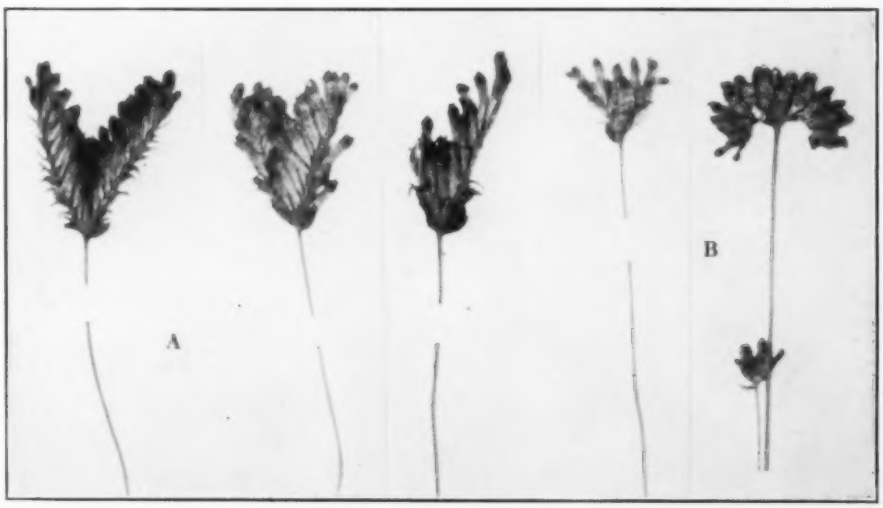

FIG. 2. A. BURMANNIA BRACTEOSA × 5/3. B. BURMANNIA CAPITATA × 5/3

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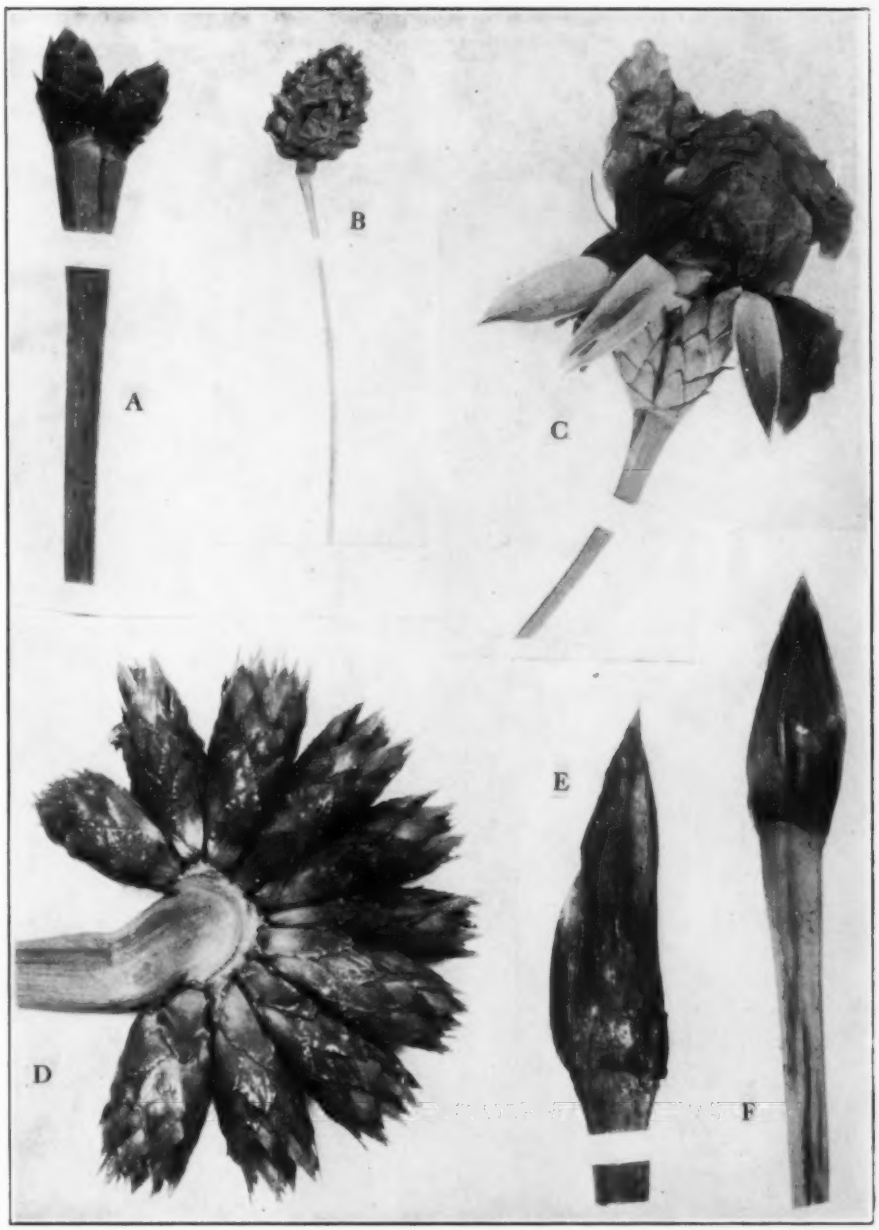
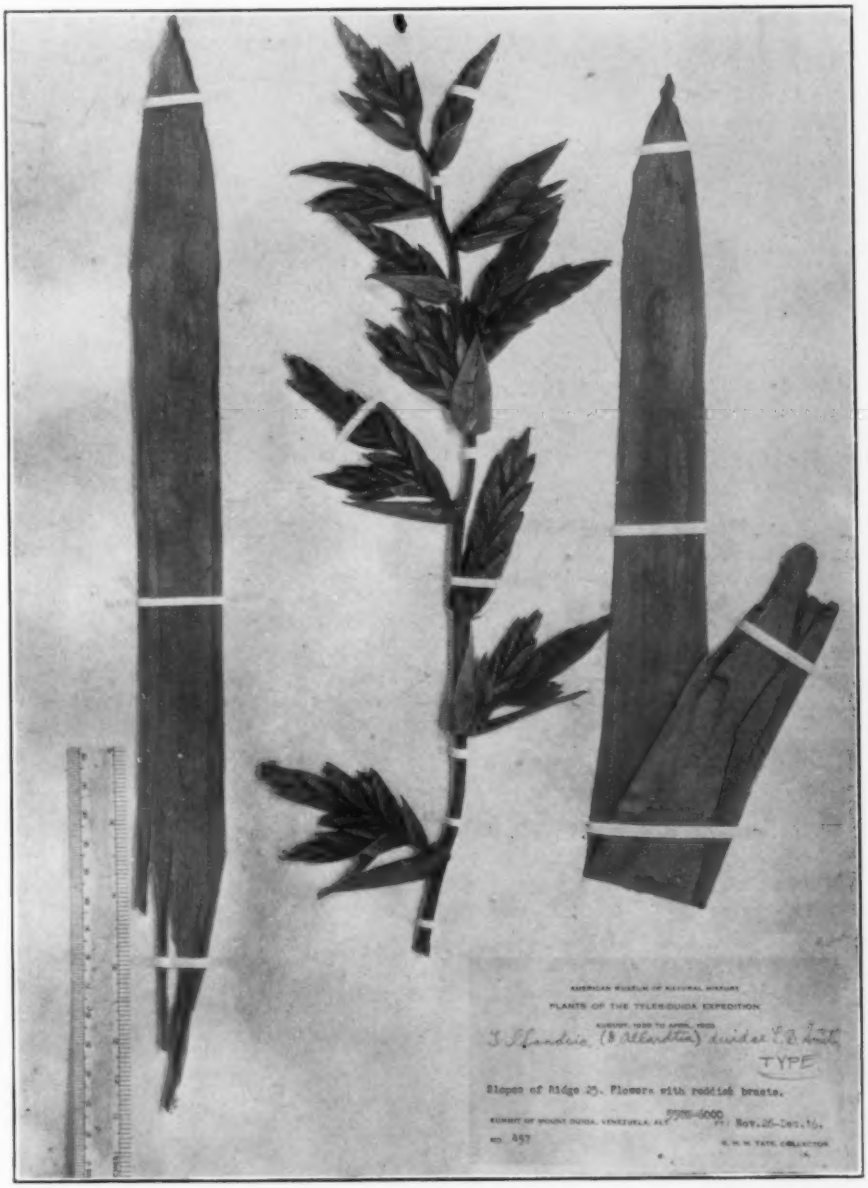


A STEGOLEPIS LINEARIS. B. MONOTREMA XYRIDOIDES. C. STEGOLEPIS PAUCIFLORA. D. STEGOLEPIS PUNGENS. E. F. AMPHIPHYLLUM RIGIDUM. ALL ENLARGED ONE FOURTH

OF MICH


AMERICAN MUSEUM OF NATURAL HISTORY
PLANTS OF THE TYLER-DUIDA EXPEDITION
T. Landia (§ Allardtia) duidae L.B. Smith
TYPE
Slopes of Ridge 25. Flowers with reddish bracts.
SUMMIT OF MOUNT DUIDA, VENEZUELA, ALT.
Fl. Nov.25-Dec.15.
no. 457
H. H. W. TATE COLLECTION

TILLANDSIA DUIDAE X 3/8

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